"RED BOOKS" of the
BRITISH FIRE PREVENTION COMMITTEE—No. 179.
Edited by the Executive.

CELLULOID DANGERS

WITH

SOME SUGGESTIONS

BEING MEMORANDA COMPILED IN CONSULTATION WITH THE COMMITTEE'S EXECUTIVE BY

D. W. WOOD

Hon. Secretary of the International Fire Library

WITH EIGHT PLATES OF TABLES AND ILLUSTRATIONS

LONDON, 1913.

PUBLISHED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
(*Founded* 1897—*Incorporated* 1899).
8 WATERLOO PLACE, PALL MALL.

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Two Shillings and Sixpence.

OBJECTS OF THE COMMITTEE.

The main objects of the Committee are:

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimizing the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods, and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

The Committee is not responsible for the views of individual authors as expressed in Papers or Notes, but only for such observations as are formally issued on behalf of the Executive.

Similarly the Committee is not responsible for any translation or any summarized translation or explanation of its Reports in a foreign language, even if issued in conjunction with the official English version.

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CHARLES ADAMI, *Assistant Secretary.*

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NOTE.

For some years the British Fire Prevention Committee has called attention to the increasing fire dangers of Celluloid.

The Building Act Amendment Act of 1905 was intended, among other things, to meet these ever-increasing dangers of Celluloid by affording a more ready means of escape from premises where this highly-inflammable material was stored, sold or used, and it was hoped that by the beneficial application of this Act in the many thousands of places affected in London a useful example would be set to our great provincial centres, where the same risk of fire prevails.

Unfortunately, for reasons upon which it is not necessary to dwell in these pages, the application of the Act in the London County area has been both slow and lenient, and thus the full benefits anticipated have not been obtained.

The Cinematograph Act of 1909, which was framed to meet the Celluloid dangers in places of public entertainment, has, on the other hand, been most judiciously and usefully applied in many parts of the country, whilst in London in particular its application has been eminently beneficial.

Unfortunately, however, the necessary restrictions as to the storage and handling of Celluloid films, outside actual places of public entertainment, at the Celluloid film depot and the Celluloid renter's repairing shop have not yet been subjected to special control.

Notable fires in which Celluloid has played a part and lives have been lost have latterly awakened the public to the dangers of this material, whilst the film-renter's store in crowded neighbourhoods and the use of Celluloid in general workshop practice has claimed the attention of those to whom the safety of life is committed. Thus the London County Council and the Corporation of the City of London have introduced into Parliament Bills with a view to obtaining the necessary powers to control the manipulation, handling and storage of Celluloid, but up to the present their efforts have not resulted in any addition to the Statute Book.

The present Secretary of State for Home Affairs has now, however, deemed it advisable to consider whether something should not be done rather on national than on local lines ; and for this reason — acting on advice—he has constituted a

Departmental Committee to inquire into Celluloid Dangers and their possible remedy.

The British Fire Prevention Committee is desirous of laying before the Departmental Committee in question some of the data on Celluloid fires collected in the past, together with the views arrived at by its Executive in consultation with the Sub-Committees concerned.

Memoranda have been prepared summarizing the data and the opinions, the preparation of which has been entrusted to Mr D. W. Wood, the Hon. Secretary of the Committee's International Fire Library, whose technical interest in the subject is well known, and who has been also deputed to give evidence on behalf of this Committee at the inquiry in question.

The Memoranda here presented, are largely the results of the Committee's tests and researches.

As will be seen, the Memoranda are divided into two parts, the first dealing with the special dangers of Celluloid, including Cinematograph films, the various uses to which Celluloid is put, and a large number of fires in which Celluloid has been a feature; whilst the second part deals with the extinguishing of Celluloid fires, and makes suggestions as to the desirability of promulgating warnings to the public and traders concerning the dangers of Celluloid and the advisability of marking all Celluloid goods, and finally puts forward the views of the Committee as to the necessity for definite legislation on the subject.

To what extent the data may be found useful to the Home Government and to the authorities concerned in the Colonies and abroad remains to be seen; but, speaking on general lines, it appears to the Executive that the solution of the problem has become very urgent for all parts of the British Empire.

ELLIS MARSLAND,
Gen. Hon. Secretary.

The Offices of the
British Fire Prevention Committee,
8 *Waterloo Place,*
London, S. W.
January, 1913.

CELLULOID DANGERS

WITH

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Hon. Secretary of the International Fire Library

PART I.

THE DANGERS.

I. SPECIAL DANGERS OF CELLULOID.

Celluloid is a substance made by mixing Nitro-cellulose and Camphor, with some other ingredients for colouring and giving different effects to the compound according to the particular object for which it is intended to be used. The Camphor is sometimes replaced by camphor substitutes. A small amount of alcohol is used to dissolve the camphor to enable the latter the more readily to act as a solvent to the Nitro-cellulose; for Camphor has the remarkable property of acting as a solvent on Nitro-cellulose.

In view of its composition it is of course exceedingly inflammable, burning with incredible rapidity, emitting large quantities of dense smoke.

Again, a most striking feature of Celluloid fires is the intense heat that is generated in but a few seconds owing to the extreme rapidity with which the material burns, as also the extraordinary fierceness of the flame.

This has been proved by the Committee in numerous tests with Celluloid scrap extending over a period of nearly six years, particulars of which will be found in a number of the Committee's reports.

It would seem, too, from tests that have been made by scientists that the ignition temperature of Celluloid varies according to its quality—the better the quality the higher the ignition point—and also to some extent to the colouring matter which has been used in its manufacture. For instance, the average ignition point of 6 teeth of a cream coloured Celluloid comb was 383° F., whilst 3 tortoiseshell Celluloid buttons were ignited at an average temperature of 312° F.

The British Fire Prevention Committee has been further advised by its Medical Officer that the shock to the human system by even a very small quantity of material that flames rapidly and burns fiercely is in itself of great danger to life, apart from the actual burning effect.

These most serious dangers are all confirmed by the particulars of Fires occurring both at home and abroad which are given on other pages of this book.

From these lists of Fires it will also be seen that many either occurred through carelessness due in the majority of cases to the ignorance of the general public as to the dangers of this material, or they could have been easily prevented if some comparatively slight additional precautions had been taken.

Further instances of the want of commonsense care are detailed in H.M. Chief Inspector of Factories, etc., Reports, from which quotations are made as follows:—

Report for 1903, *cd.* 1904, *p.* 214.
2139

> Naked gas lights are used for illuminating the workrooms and in close proximity to the workers where the article manufactured is highly inflammable or combustible, such as celluloid. . . . I visited a factory this year in a small country town where articles were being manufactured from celluloid. The factory was an old disused chapel standing among the houses in the main street, it had wooden floors and a wooden ladder-like staircase inside. Celluloid was everywhere scattered about, on the middle floor boxes of waste pieces of celluloid were deposited awaiting removal. The stock of celluloid awaiting manufacture is stored in the back yard in isolated buildings, but no precautions are taken with regard to that brought inside the factory. There are no means of escape provided for the workers, who number 38. There are no means, such as sand or blankets, kept handy for extinguishing flames. Here is a source of danger to the whole town situated in its very midst, and yet I have tried as it seems in vain to rouse the occupiers to take any precautions for the safety of their employees or of surrounding property.

Report 1904, *cd.* 1905, *p.* 212.
2569

> Formerly the shavings from the different shops were thrown on to the dust heap, but I learn now that a commercial value has been found for refuse of this sort. It is bought by certain manufacturers to convert into a kind of imitation leather for covering books, etc. This leads to large quantities being kept in the shops.The tenants of these shops are generally know as " little masters," with little capital, and few appliances beyond what are absolutely necessary for the carrying on of their business; consequently, instead of the shavings being stored in metal boxes, drums, or other suitable receptacles, they are put into old sacks. A spark from a man's pipe, or from the hearth, or even from a glazer, will cause the sacking to smoulder and frequently lead to the ignition of the contents. Many fires, I believe, may be attributed to this cause.
>
> Another source of danger—disregarded, indeed not believed by most people—lies in the fact that the heat generated by the boring instrument causes ignition. It was confidently asserted that the heat would so soften the material that there would not be friction sufficient to generate flame; but certain practical cutlers told me that they had known fires to occur from this cause. One man made the following statement: " The handle of Xylonite waste which I was boring caught fire while I was

withdrawing the tool. The flame from it set fire to a pile of about 17 dozen handles from my bench. No one in the shop was smoking at the time." It may here be pointed out that these fires are due to the drill used being too thick in the shank, thus causing unnecessary friction.

Report for 1908, *cd.* 1909, *p.* 67.

4664

Fires have occurred from the use of Xylonite in two cutlery works. In both these cases the fire started in the fan pipes used for the removal of the Xylonite dust, and were due to badly designed branch pipes. There is always danger . . . when steel and Xylonite dust enter the same fan duct, though at different branches, as the slightest smoulder will quickly be fanned into a flame. He also points out the danger of filing Xylonite close to naked gas lights, but adds that the cutlery workers are slow to realize the risk they are running until a fire actually takes place.

Report for 1908, *cd.* 1909, *p.* 80.

4664

Appendix on dust removal in the grinding trades. Special care is necessary in designing plants intended for dealing with inflammable dust, such as Xylonite, to prevent the lodging of the dust within the pipes, which would be a source of danger from fire.

Report for 1909, *cd.* 1910. *p.* 19.

5191

A very dangerous practice was discovered in a cinematograph film factory. . . . . Large sacks full of celluloid waste from the manufacture of films were stacked in the factory; and the manager was by no means alive to the immense danger of such storage.

Report for 1909, *cd.* 1910, *p.* 28.

5191

In a factory where celluloid dissolved in spirit was used, the measures for preventing a fire, or dealing with any fire which might occur, were very unsatisfactory.

Report 1909, *cd.* 1910, *pp.* 52–53.

5191

Mr. Parkes (Derby) reports that a very startling fire (or explosion) occurred where non-flammable handles for cutlery are made. The fire (or explosion) took place in a warehouse where no manufacturing process is carried on. By some means—either by a spark or by spontaneous combustion—a whole stack of about 200 bags of material of a mixed kind and containing celluloid scraps fired immediately. The roof was partially blown off, and great volumes of flame passed over the adjoining public road for some fifty yards, damaging property on the other side of the road. It was fortunate that only one man was injured by the flames in making an attempt to put out the fire.

Slight fires have occurred during the ironing process at laundries through Celluloid collar supports being left in ladies' blouses, etc., when sent to be washed.

An instance of the ease with which Celluloid can be set on fire by the sun's rays was obtained when the following experiment was made:

Between 11 a.m. and 1 p.m. on a bright day in December the sun's rays were focussed on to some Celluloid by means of an ordinary concave mirror having a diameter of 4.4 inches. The focal length was 12 to 15

inches, showing that the sun's rays could easily be brought to a focus in a shop window. The result showed that the Celluloid fired very quickly, although in no case did it actually flame. The temperature of the air (in the sunshine) was 46.4° F., whilst an ordinary thermometer bulb which was placed at the focal point, rose to about 176° F., and the bulb covered with lampblack rose to 383° F. As the firing point of Celluloid is usually from 338° F. to 356° F. it is evident that some of the fires for which the causes are recorded as "unknown" can be easily accounted for in shop windows.

It should also be borne in mind that the Celluloid base used in cinematograph films is of a very different character, chemically speaking, to that used for making up into articles of everyday use.

As previously stated, Celluloid is a mixture of nitro-cellulose and camphor, whilst the Celluloid used as a base for cinematograph films is composed of nitro-cellulose in which the nitration has been carried further and as small an amount of camphor is used as a solvent as is possible. This therefore renders this Celluloid base more dangerous.

The Committee recently undertook tests which proved that Celluloid in the form of Cinematograph films would burn under water or in carbon dioxide. Particulars of these tests with records of the results obtained are set forth in the Committee's Red Book No. 176 on page 22, Test No. 9, and page 17, Test No. 6 respectively, and extracts therefrom read as follows:

TEST No. 9.

Object of Test No. 9.—This test was undertaken to show that celluloid film ignited and thrown into water continued to burn and to produce smoke and gas. . . . .

Arrangement for Test No. 9.—A roll of celluloid film was provided and a bucket of water.

Log of Test No. 9.

A roll of *Celluloid* film approximately 4in. *(0·1016m.)* in diameter was fastened to a wire with a lead weight attached. The film was ignited by a lighted taper and almost immediately it was plunged into a pail of water and extinguished.

Repeat.—Another similar roll of *Celluloid* film was prepared in the same way and after burning for 10 secs. it was plunged into a pail of water. The water began to boil on the surface almost at once, the gases generated becoming ignited above the water, and the film continued burning until it was almost entirely charred. On the film being withdrawn from the water and a light applied the remainder burst into flame. A dense pungent smoke was emitted.

Log of Re-test No. 9.

A similar test was made with *Celluloid* film. The film burnt for 10 secs. and was then plunged into the water, where it burnt for 27 secs., flames rising about 14 in. *(0·3555m.)* above the water. A dense pungent smoke was also emitted. When the film was removed it was found to be entirely charred (*see* Plate I annexed to this statement).

TEST No. 6.

Object of Test No. 6.—This test was undertaken to show the behaviour of burning celluloid film . . . . in pure Carbon Dioxide.

Arrangement for Test No. 6.—Two glass vessels containing CO_2 and covered with asbestos boards were used. The gas had been generated in the plant . . . .

A small roll . . . . of Celluloid . . . . film had been provided.

Log of Test No. 6.

Into the . . . . vessel a similar roll of *Celluloid* film, the end of which had been ignited, was placed and although the flame was extinguished in 7 secs. the film continued to burn, giving off very dense fumes until all the film was charred.

Log of Re-test No. 6.

A *Celluloid* film was tested in a similar manner to the last mentioned with the same result, the flame being extinguished in 7 secs.

In both these tests exceedingly dense, penetrating and irritating fumes were given off in large volumes, and it has been found that these contain gases which will readily ignite in the air.

Further, it has been proved that these products of decomposition or smoke consist largely of very poisonous gases (carbon monoxide, nitrogen dioxide, etc.) and these gases when mixed with the correct proportion of air form violent explosive mixtures, *vide* United States Geological Survey Department's Bulletin in connexion with the fire at Pittsburg, September 27, 1909. (*See Appendix II.*)

The temperature at which Celluloid films will ignite is very low, and tests which have been made by scientists confirm the tests made by the Committee.

These tests are set forth in the same Red Book on page 24, Test No. 11, and the extract reads as follows:

TEST No. 11.

Object of Test No. 11.—This test was undertaken to show at what temperature celluloid . . . . films will decompose and ignite.

Arrangement for Test No. 11.—Two glass test tubes about 6in. (*0·1524m.*) in length and $\frac{3}{4}$in. (*0·0190m.*) diameter were suspended in a gas-heated oil bath about 7in. (*0·1778m.*) in diameter containing linseed oil. A thermometer was also held in the bath. In one tube was a piece of celluloid film about $2\frac{1}{2}$in. (*0·0635m.*) in length. . . . .

Log of Test No. 11.

The oil gave a temperature of 59° F. (*15° C.*) when the gas was lighted. In 5 minutes at a temperature of 375° F. (*190° C.*) the *Celluloid* film was blown out of the tube and burned with a flash. . . . .

The test was repeated, the initial temperature of the oil being 296° F. (*147° C.*) when the gas was lighted; in 1 min. 45 secs. a change was noticeable in the *Celluloid* film which was blown out of the tube and fired in a similar manner, in a further 6 secs. at 362° F. (*184° C.*) . . . .

A third piece of *Celluloid* was put in a tube when the temperature was 291° *F.* (*144° C.*) and the gas lighted. The film was blown out and fired at 366° F. (*186° C.*) in 2 min. 4 secs.

It is noticeable that since the Cinematograph Act, 1909, fires in cinematograph theatres, etc., have been very few, but there is a slight tendency for the number of accidents to increase (beyond the proportion due to the larger number of buildings occupied for this purpose) owing to the projectors or cinematograph machines being driven by electric motors.

The new danger arising therefrom is that the film may break and the machine will go on running, with the result that the film is still being delivered from the spool box, and therefore there is a considerable quantity of exposed film about the machine. Mechanical propulsion also means a certain risk of the appliance being left unattended as the operator may not consider his continuous attendance essential, and such neglect involves additional risk.

It may be here remarked that in some countries machines driven by other than manual power are not allowed.

One of the Inspectors of the London County Council (who was also attached to the London Fire Brigade) when giving evidence in June, 1912, for the L.C.C., when the Council's General Powers Bill was before the Committee of the House of Commons, stated that there appeared to be a lack of appreciation of the danger from fire involved by the use of large quantities of Celluloid, and cited the following instances:

> "In the first case the premises were fitted with wooden partitions; there were approximately 250,000 ft. of film stored there, and the films were in cardboard boxes for the most part; some 30 or 40 films without any cover."
>
> "In the second case he noticed that only one of the spools of the projecting machine was enclosed in the spool box, and the projecting room was used as a paper and letter store."
>
> "At the third premises he called at, both he and the manager were smoking cigarettes when they entered the film store. More than half of 20,000 ft. of film was unprotected. He put out his cigarette, but the manager continued smoking." (*Bioscope, June* 13, 1912.)

II. CELLULOID USES.

In order that the great extent of the application of this highly inflammable material may be appreciated, the following list of some of the uses of Celluloid in various forms has been compiled:

DRESS AND PERSONAL. (*See also Fancy Goods.*)

Artificial Flowers

Beads
Belt Clasps
Belts, Fancy
Blouse Fasteners
Boot and Shoe Heels
,, Eyelets and Hooks
,, Tops
,, Buttons
Brooches
Buckles
Buttons: Boots and Shoes
,, Gloves

Cap-peak Stiffeners
Collars
Collar Studs
,, Supports
Combs
Cuffs

Dress Strips

Fronts

Glove Buttons
,, Fasteners

Hair Pins and Slides
Hat Bands

Imitation Eyelets for Corsets, Rugs, etc.
Imitation Jet Ornaments
Inner Toe-Puffs for Boots

Lorgnettes

Protectors, Cuff

Sequins
Shoes (*see* Boots)
Spangles
Studs

Teeth, Artificial

FANCY GOODS. Home and Personal.

Artificial Flowers
Artistic Furniture

Badges
Bag Fittings
Bonnet and Hat bag and box Accessories
Brushes of All Sorts
Brush Trays
Buhl Work
Buttonhooks

Cabinets
Capsules for Glass Jars
Card Markers
Chemists' Sundries
Cigar and Cigarette Cases
Cigar and Cigarette Holders
Clock Faces and Ornaments
Clock and Watch Cases
Court Plaster Cases
Cutlery

Darning Eggs
Dressing Cases
Drinking Cups

Electric Bell Fittings

Fancy Needle Cases
Fans
Funnels
Furniture:
  Imitation Antique
  Artistic

Gas: Imitation Candles for Gas Burners
Glove Stretchers

Hairpin Cases and Tubes
Hatpin Stands

Key Labels
Knife and Fork Handles

Labels
Lavatory Handles
Lorgnettes

Manicure Cases and Fittings
Medallions
Mirrors

Parasol Handles
Pen and Pencil Cases
Penholders
Photograph Frames
Pin Trays and Cushions
Platelifters
Playing Card Cases
Pocket Knife Scales
Poker Chips
Powder and Ointment Boxes
Puff Boxes

Railway Ticket Cases
Razor Scales
Reading Glasses
Respirators
Ring Stands

Salad Servers
Serviette Rings
Shoe Lifts
Soap Cases and Tubes
Spectacle Cases
  ,, Frames
Sponge Boxes and Baskets
Stamp Cases
Sunshade Handles
Surgical Belts

Tape Measures
Thimbles
Toilet Cases
  ,, Sets
  ,, Tidies
Tooth Brush Stands
Toothpicks
Trusses

Umbrella and Walking Stick Handles

Watch Stands
Window Cord Holders

FANCY GOODS. General.

Advertisers' Novelties
Fancy Goods Manufacturers
Holy Water Stoups
Imitation Ivory Turned Work
Marqueterie
Statuettes

MUSICAL.

Banjo Pegs
Clarionette Parts
Drum Sticks
Electric Piano Fittings
Harmonium Key Boards
Musical Instrument Cases
Organ:
  Key Boards
  Stops
Piano:
  Key Boards
  Player Covers

SPORTS, TOYS, Etc.

Accumulator Boxes
  ,, Separators
Athletic Articles
Automobile Sundries
Bagatelle Chalk Holders
Balls
Bassinette Handles
Billiard Chalk Holders
  ,, Rests
  ,, Scoring Pegs

Card Markers
Carriage Fittings
Chess Men
Cinematograph Films (*see Special Reference*)
Coach Fittings
Conjuring Trick Apparatus
Croquet Clips
Cycle Accessories
,, Gear Cases
,, Handles
,, Handle Bars
,, Mud Guards
,, Pumps

Dice
Dog Collars
Dolls' Heads
Dolls
Dominoes
Draughts

Fishing Tackle, Bait and Flies
Floating Toys

Garden Labels
Gear Cases

Harness: Cheek Piece
,, Coupling Rings
,, Martingale Rings
,, Rosettes

Motor Car Fittings
,, Hood Windows
,, Screens
,, Steering Wheels
Mud Guards

Perambulator Handles
Photographic Cameras
,, Chemicals
,, Films
,, Trays
Pipe Mouthpieces
Playing Card Cases
Poultry Rings

Rattles
Rein Stops

Teething Rings
Toy Animals

Van Windows

Whip Handles
Window Cord Holders

STATIONERY AND OFFICE.

Adding Machine Keys
Advertisement Covers
Albums
Almanacks
Automatic Time Recorders

Blotting Pad Covers
Book Covers
,, Markers
Brush Tubes

Cards: Birthday
,, New Year
,, Valentine
,, Xmas

Date Stands

Drawing Office Materials

Fancy Stationery
Fountain Pens

Gold Blocked Cards

Indexing Cards

Labels
Manifold Book Plates
Map Covers and Cases
Memorandum Tablets

Paper Knives
,, Weights, etc.
Pen and Pencil Cases
Pens
Penholders
Playing Card Cases
Pocket Book Cases
,, Tablets
Prayer Book Covers

Rulers

Show Cards
Stamp Cases
Stationers' Sundries

Telephone Mouthpieces
,, Parts
,, Sleeves
Typewriter Cases and Covers

SCIENTIFIC AND SURGICAL.

Barometer Scales

Chemical Apparatus, Spatulas
Chemists' Sundries
Collodion Cotton

Drawing Instruments
,, Curves

Eye Shades

Finger and Thumb Stalls
Finger Shields

Lens Mounts

Mathematical Instruments
,, Rules
Meteorological Instruments and Scales

Medicine Cups
Micrometer Scales

Plastic Limb Casings
Protractors

Set Squares
Slide Rules
Splints
Surgical Instruments

FACTORIES AND SHOPS.

Accumulator Boxes
,, Separators
Automatic Weighing and Packing Machine Covers
Beer Engine Handles
Celluloid Scrap
Colour Pattern Cards
Cutting Plates and Bars
Funnels
Glass, Reinforced
Labels
Lacquers (*see Separate Heading*)
Jewellers' Sundries
Oilcans
Printers' Cutting-Out Blocks
,, Shooting Sticks
Tailors' Pattern Cards
Tobacconists' Sundries
Van Windows
Washers
Window Tickets

CELLULOID LACQUERS.

Acetylene Gas Fittings
Aluminium Paint
Art Metal Work
Bedsteads
Bookbinders' Cloth
Bowls
Bronzes
Bronze Powder
Calico Printing
Cartridges
Cartridge Cases
Corset Tips
Crepe
Croquet Balls
Croquet Mallets
Electro Plate
Enamels
Felt Hats
Gilders
Gold Paint
Hockey Clubs
Imitation Leather
Incandescent Mantles
Japan
Lavatory Seats and Furniture
Leather Cloth
Picture Postcards
Polo Heads
,, Balls
Printers' Blankets
Splints
Stay Steel Tips
Straw Hats
Varnish
Waterproof WallPaper
W.C. Seats
Wood Stains

Note: Artificial Silk has not been included.

Regarding the rapidly increasing use of Celluloid in the form of Cinematograph films and as an illustration of the extent of the development of this industry the following particulars from the Cinematograph trade journals may be quoted:

> "Mr. J. B. Wilkinson, Secretary of the Incorporated Association of Kinematograph Manufacturers, Ltd., one of the petitioners against the L.C.C. General Powers Bill in June, 1912, stated in his evidence before the Committee of the House of Commons that there were
>
> "32 manufacturers (? *producers*) of films in this country,
>
> "80 firms engaged in renting, and some
>
> "4,000 to 5,000 Cinematograph Theatres."—*Bioscope*, 20/6/12.

> "During October (1912) 561 different subjects are to be released which is equivalent to 7,000 different motion picture subjects put before spectators in one year . . . . to produce these 561 subjects 376,815 ft. of positive and negative have been required, not taking into account the waste. Supposing only 10 prints were made of each subject this would mean 4,144,965 ft. used in a month or in the course of 12 months 49,743,580 ft. of film."*
>
> *Kinematograph*, 10/10/12.

Note.—One reel of film ordinarily contains 1,000 ft. and weighs about 5 lb.; the diameter of the reel is approximately 10 inches.

As each picture is $\frac{3}{4}$ in. deep there are 16,000 in one reel, and it takes about 15 to 20 minutes to pass the reel through the machine; this means that about 16 pictures are shown each second.

* (? 49,739,580 ft.)

It may here be noted that the term "Celluloid" is not in any way registered as a trade name or mark by any firm in this country, but that it is in the United States, consequently the general name employed in that country is Pyroxylin plastics.

Further, Xylonite is a registered trade name in this country.

III. FIRES IN WHICH CELLULOID HAS BEEN A FEATURE.

The British Fire Prevention Committee, as a result of various inquiries it has made, has been enabled to draw up several lists of fires which, however, include some fires that may be considered of relatively minor importance, if only extent is considered, but which claim attention for technical reasons.

It must also be borne in mind that many fires in buildings might, strictly speaking, be attributed to Celluloid, but that owing to the methods of classifying the causes of fires obtaining in many fire brigades it is quite impossible to put forward complete data.

In the same way some fires in buildings have been included in these lists which did not actually originate in or through Celluloid, yet the serious damage done or the number of lives lost was really due to Celluloid which, in some form or another, was on the premises and became ignited through the fire.

On Plate I will be found a list of some Celluloid fires on the person or in dwellings.

Then some peculiar instances of fires where the Celluloid was in transit are given on Plate VII.

On Plates II and III will be found a list of some of the fires in the United Kingdom where unfortunately but little effort has been made to keep records except latterly in London. These lists must only be used as an indication of the nature of fires occurring, and not in any way as an indication of their number and far less as a complete lists.

Lists of fires from three continental capitals, an industrial city and a seaport where some records appear to have been kept since about 1900, and thus may be deemed useful for comparative purposes, follow on Plates V and VI, the capital cities being Paris, Berlin and Vienna; the industrial city Leipsic and the port Hamburg.

Then on Plate VII a special list of fires in Celluloid factories in three States of the United States of America is presented.

Finally, on Plate VIII a list of some few notable fires is added that have occurred elsewhere, but which claim attention for technical reasons.

It will be observed that the fires in these lists have been classified so as to give some idea of their character, i.e. under the headings:

A. CELLULOID WORKS, *i.e.* (1) making the raw Celluloid; (2) manipulating or making up goods from Celluloid.
B. CELLULOID IN SALE SHOPS.
C. CINEMATOGRAPH FILM STORES, etc.
D. CINEMATOGRAPH THEATRES.

PLATE I

SOME CASES IN PRIVATE LIFE OF CELLULOID FIRES ON THE PERSON OR IN DWELLINGS.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
—/6/97	—	—	WOLVERHAMPTON.	Private Dwg. House.	Lighted taper falling on celluloid keys of organ.
29/1/98	—	1	NEWCASTLE.	.. .. ..	Burning creosote on collar.
2/1/99	—	—	BIRMINGHAM.	.. .. ..	Sparks falling on celluloid thimble.
—/11/02	—	—	—	Amateur Photographer.	Celluloid dishes placed on kitchen boiler top.
10/8/04	—	—	—	Private Dwg. House.	Candle shade falling on celluloid.
—/—/05	—	—	KILBURN.	,,	Drying dog in front of fire; comb ignited.*
13/9/06	1	2	MOFFAT.	,,	Reading near fire; comb ignited.
—/2/08	1	—	WORKINGTON.	,,	Spark from fire on comb.
4/10/08	—	—	ROTTINGDEAN.	,,	Sun's rays on combs on dressing-table.
—/9/09	1	—	SHEFFIELD.	,,	Heat from fire whilst cleaning grate ignited comb.
30/3/10	1	—	GAINSBOROUGH.	,,	Making toast: comb ignited.
5/6/10	—	—	LONDON.	,,	Toy cinematograph machine.
14/9/10	1	—	SHREWSBURY.	,,	Match thrown on collar.
13/10/11	1	—	LIVERPOOL.	,,	Standing near lamp. Hair caught fire and ignited comb.
—/4/12	1	—	SHEFFIELD.	,,	Candle ignited collar.
26/9/12	—	—	LONDON.	,,	Toy cinematograph lantern
12/10/12	—	1	,,	,,	Experimenting with films.
—/1/13	—	1	RICHMOND, YORKS.	,,	Cleaning hearth; spark from fire on comb.
6/1/13	—	—	CHICHESTER.	,,	Matches on collar.
6/1/13	—	—	SUNDERLAND.	,,	Spark from arc lamp on collar.
25/3/02	—	—	BERLIN.	Dwelling.	Carelessness with light.
11/2/06	—	—	,,	,,	Celluloid combs in box: box behind hot oven.
26/4/06	—	—	,,	,,	Film. Unknown.
21/7/09	—	—	,,	,,	Celluloid in kitchen. Carelessness.
20/11/12	—	1	HAMBURG	.. .. ..	Celluloid comb in child's hair, too near kitchen lamp. Comb caught and then clothes.
20/2/00	—	—	LEIPSIC.	Bedroom.	Burning cigar laid on celluloid dish.
14/1/01	—	—	,,	,,	End of glowing match falling on celluloid soap dish.
7/2/02	—	—	,,	,,	Heat of spirit lamp near celluloid comb.
10/5/02	—	—	,,	Sitting-room.	Match on celluloid comb.
11/11/02	—	—	,,	Bedroom.	Glowing match on celluloid comb.
24/11/03	—	—	,,	Sitting-room.	,, ,, ,,
31/1/04	—	—	,,	,,	Flame of spirit lamp on celluloid comb.
28/6/05	—	—	,,	Bedroom.	Glowing end of match on celluloid comb.
16/9/05	—	—	,,	,,	Candle on celluloid hairpins.
20/2/06	—	—	,,	Kitchen.	Glowing end of match on celluloid comb.
15/5/06	—	—	,,	Sitting-room.	Celluloid shavings touched with hot fire-irons.
,,	—	—	,,	Bedroom.	Candle on celluloid comb.
4/10/06	—	—	,,	,,	,, ,,
29/1/07	—	—	,,	,,	,,
11/4/07	—	—	,,	Sitting-room.	Flame of spirit lamp blown against celluloid combs.
6/5/07	—	—	,,	Bedroom.	,, ,, ,, ,,
20/6/07	—	—	,,	,,	Glowing end of match on celluloid comb. ,, ,, ,,
28/8/07	—	—	,,	,,	,, ,, ,, ,,
8/9/07	—	—	,,	,,	Flame of lamp blown on to celluloid comb.
17/10/07	—	—	,,	,,	Candle on celluloid comb.
5/11/07	—	—	,,	,,	Match on celluloid tray.
27/12/07	—	—	,,	Sitting-room.	Match on celluloid comb.
13/1/08	—	—	,,	Kitchen.	End of match on celluloid comb.
18/2/08	—	—	,,	Sitting-room.	Cigar on celluloid comb.
18/3/08	—	—	,,	Kitchen.	Celluloid brushes and combs put to dry on stove.
6/5/08	—	—	,,	Bedroom.	Flame of spirit lamp blown on celluloid comb.
1/6/08	—	—	,,	Spare room.	Heat of spirit lamp on celluloid combs.
26/9/08	—	—	,,	Bedroom.	Match on celluloid comb.
14/11/08	—	—	,,	,,	Match set fire to tablecloth and celluloid comb thereon.
28/11/08	—	—	,,	Sitting-room.	Celluloid comb on petroleum lamp.
4/12/08	—	—	,,	Bedroom.	Match on celluloid comb.
8/12/08	—	—	,,	,,	,, ,,
20/12/08	—	—	,,	Sitting-room.	Heat of gas lamp fires celluloid comb.
2/2/00	—	—	,,	Kitchen.	Celluloid brushes put on oven to dry.
16/2/09	—	—	,,	Sitting-room	Match touches film of child's cinematograph apparatus.
25/2/09	—	—	,,	,,	Overheating of spirit lamp near celluloid combs.
7/3/09	—	—	,,	Bedroom.	Flame of spirit lamp blown against celluloid combs.
4/9/09	—	—	,,	,,	Flame of candle blown against celluloid combs.
25/10/09	—	—	,,	,,	End of match on celluloid combs.
11/12/09	—	—	,,	Kitchen.	Match on celluloid comb.
22/12/00	—	—	,,	Bedroom.	,, ,,
22/12/09	—	—	,,	Kitchen.	Celluloid comb on cooking stove.
25/12/09	—	—	,,	Drawing-room.	Candle on celluloid comb.
18/1/10	—	—	,,	Bedroom.	Flame of candle blown on celluloid hairpins.
20/3/10	—	—	,,	,,	Portion of burning candle on celluloid hair ornaments.
2/4/10	—	—	,,	.. .. ..	Flame of spirit lamp on celluloid hair ornaments.
30/4/10	—	—	,,	Bedroom.	Burnt-out candle on celluloid hairpins.
1/5/10	—	—	,,	Kitchen.	Flame from stove on celluloid comb.
9/3/11	—	—	,,	Sitting-room	Heat of flame fires child's cinematograph apparatus.
25/12/11	—	—	,,	,,	Light brought too near child's cinematograph apparatus.
26/12/11	—	—	,,	Bedroom.	Heat of petroleum flame too near film of model apparatus.
11/6/12	—	—	,,	,,	End of match on photograph film.
15/12/12	—	—	,,	,,	Celluloid letter plate fired by candle.
7/6/11	—	—	BLANCHARD, U.S.A.	.. .. ..	Farmer working in field on hot day (100° in the shade). Sun's rays focussed by steel shovels on to his artificial leg, composed of lines and sections of celluloid, which was shattered by an explosion.

* The injured lady obtained £50 damages from the draper who sold the comb as horn whereas it was of celluloid.

Note.—No data obtainable from Paris and Vienna.

TABLES PREPARED FOR THE BRITISH FIRE PREVENTION COMMITTEE (RED BOOK NO. 179).

PLATE II

SOME CELLULOID FIRES REPORTED AS OCCURRING IN THE UNITED KINGDOM.

(Fires notified to local authorities.)

A. CELLULOID WORKS.

DATE.	LIVES LOST.	LIVES INJ.	TOWN.	TRADE.	PARTICULARS.
29/12/93	1	—	LONDON.	Xylonite Workers.	Defect in steam-heated press. Vapours generated ignited at naked gas light
14/11/94	1	7	,,	,,	Spark from saw falling on to comb dust.
18/12/94	—	—	SHEFFIELD.	Cutlers.	Spark from paper used for lighting gas dropping on celluloid handles
21/12/94	—	—	,,	,,	Celluloid turnings in contact with gas.
14/2/96	—	—	,,	,,	Unknown.
23/11/96	—	—	,,	Ivory & C. cutters.	Celluloid ignited through unknown cause.
6/4/97	—	—	,,	Cutlers.	Spark from emery wheel on celluloid.
24/7/97	—	1	WOKING.	Accumulator Fac.	Damage severe. Tons of celluloid destroyed. Factory not reopened.
2/5/98	—	—	BOW.	Cycle accessories.	Very slight. Extinguished by 3 sprinklers.
23/6/99	—	—	SHEFFIELD.	Ivory & C. carver.	Match thrown down.
10/7/99	—	—	,,	,,	Light dropped on celluloid chips.
6/12/99	—	—	,,	Cutlers,	Boring handle dust into gas and on to dust on bench.
21/12/99	—	—	,,	,,	Spark from turning handle.
12/2/00	—	—	,,	,,	Overheating of flue.
13/2/00	—	—	?	Cycle manufaet'rs.	Celluloid eases near stove.
15/2/00	—	—	SHEFFIELD.	Cutlers.	Unknown.
4/3/00	—	—	?	Comb manufaet'rs.	Defective hearth.
10/3/00	—	—	SHEFFIELD.	Cutlers.	Overheating of flue.
13/4/00	—	—	,,	,,	Unknown.
25/7/00	—	—	,,	,,	Celluloid taking fire.
11/8/00	—	—	,,	,,	Unknown.
30/11/00	—	—	,,	,,	Spark from fire.
22/12/00	—	—	,,	,,	Spark from glazer.
—/—/01	—	—	,,	,,	Defective flue.
15/2/01	—	—	,,	,,	Overheating of flue.
19/3/01	—	—	,,	,,	Unknown.
2/5/01	—	—	,,	,,	Spark from glazer.
4/7/01	—	—	,,	,,	Friction at shafting.
13/9/01	—	—	,,	,,	Spark from glazer.
21/9/01	—	—	,,	,,	Unknown.
24/11/01	—	—	,,	Bone, ivory and C. cutters.	Light thrown down.
25/11/01	—	—	,,	Cutlers.	Spark from glazer.
21/1/02	—	—	,,	,,	Unknown.
17/2/02	—	—	LONDON.	Incandescent Mantle Factory.	Unknown. Severe damage.
—/3/02	—	—	BIRMINGHAM.	Cycle fittings.	Celluloid in contact with hot-water pipes.
30/3/02	—	—	SHEFFIELD.	Cutlers.	Unknown.
26/5/02	—	—	LONDON.	Incandescent Mantle Factory.	Unknown. Severe damage.
9/6/02	10	6	,,	Electrical accessories.	Unknown. Coronation decorations.
28/8/02	—	—	SHEFFIELD.	Cutlers.	Overheating of flue.
4/11/02	—	—	,,	,,	Spark from glazer.
—/12/02	—	—	,,	,,	Celluloid.
12/1/03	—	—	,,	,,	Spark from glazer.
15/1/03	—	—	,,	Handle manfr.	Spark on celluloid handles in trays.
—/4/03	—	—	BIRMINGHAM.	Cycle pump.	Cuttings ignited.
7/5/03	—	—	,,	,,	Gas jet in contact with celluloid pumps.
7/5/03	—	—	SHEFFIELD.	Cutlers.	Light thrown down.
10/6/03	—	—	,,	,,	Unknown.
12/6/03	—	—	,,	,,	Spark from glazer.
23/7/03	—	—	,,	,,	Overheating from furnace.
19/8/03	—	—	,,	,,	Spark from glazer.
31/8/03	—	—	,,	,,	,, ,,
2/12/03	—	—	,,	,,	Light thrown down.
2/12/03	—	—	,,	,,	Unknown.
7/3/04	—	—	,,	,,	Spark from glazer.
14/3/04	—	—	,,	,,	Celluloid ignited by friction.
18/7/04	1	—	,,	,,	Spark from glazer.
30/11/05	—	—	MANNINGTREE.	Celluloid Factory.	Fire originated in stove. Eleven buildings destroyed.
29/12/05	1	—	LONDON.	Collar Factory.	Taking stock by candle light.
31/1/08	—	1	,,	C. Case makers.	Burning rubbish.
28/6/08	1	6	,,	Showeard Factory.	Celluloid cuttings in contact with steam pipes.
4/11/08	—	—	,,	Accumulator Fac.	Unknown.
9/11/08	—	—	,,	Cycle maker.	Celluloid goods in contact with gas.
25/2/09	—	—	SHEFFIELD.	Cutlers.	Match dropped. Burnt out.
10/11/09	—	1	DRONFIELD.	Cutler's handles.	Spontaneous ignition of dust.
5/4/10	—	—	LONDON.	Accumulator Fac.	Spark from fire.
18/11/10	3	—	BIRMINGHAM.	Collar stud.	Searching among bags of celluloid waste with lighted paper and match.
23/7/12	9	4	LONDON.	Christmas cards.	Melting sealing wax on parcel.
31/7/12	—	—	,,	Bookbinders.	Gas stove. Severe damage.
3/11/12	—	—	,,	Incandescent mantle store.	Unknown. Severe damage.

TABLES PREPARED FOR THE BRITISH FIRE PREVENTION COMMITTEE (RED BOOK No. 179).

PLATE III

SOME CELLULOID FIRES REPORTED AS OCCURRING IN THE UNITED KINGDOM.

(Fires notified to local authorities.)

B. CELLULOID IN SALE SHOPS.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
21/12/94	—	—	HULL.	Hotel.	Celluloid handles igniting.
—/2/97	—	—	BIRMINGHAM.	Cycle dealers.	Gas jet pushed against celluloid gear cases.
—	—	—	—	Hairdresser.	Defective electric light wiring.
—	—	—	—	Jeweller.	Comb in window ignited.
8/4/98	—	—	LIVERPOOL.	Chemist.	Sun's rays on goods in shop window.
8/4/98	—	—	COLCHESTER.	.. .. ..	,, ,, ,, ,,
8/6/01	—	—	ASTON MANOR.	Chemist.	,, ,, ,, ,,
7/7/04	—	—	COVENTRY	Motor Parts dealer.	Sun's rays acting through window on celluloid cases on bench.
29/5/05	—	—	ATTLEBOROUGH.	Hairdresser.	Sun's rays on goods in shop window.
16/11/06	3	—	BERMONDSEY.	Haberdashers.	
13/4/07	—	—	LONDON	Jewellers and Fancy Goods.	Fire inquest: fire due to close proximity of celluloid goods to electric lamp or wires in window.
26/11/07	—	—	,,	Toys & Fancy Gds.	Originated in fancy goods depot; rapidly attained serious proportions owing to large stock of celluloid goods and films.
31/5/08	—	—	NEWPORT, MON.	Hairdresser.	Sun's rays on comb in window.
23/11/08	—	—	ST HELENS	Fancy Goods.	Sun's rays on goods in window
5/5/09	—	—	SOUTH PORT.	.. .. ..	,, ,, ,,
20/12/09	8	—	LONDON.	Draper.	Fire spread rapidly due to celluloid goods.
20/6/10	—	—	,,	Automobile Outfitters.	Fire in basement where celluloid goods kept.
3/1/11	—	—	THIRSK.	Fancy Goods.	Inverted gas mantle falling on combs on counter.
19/12/12	—	—	BIRMINGHAM.	Bazaar.	Spark from gas. Considerable damage.
19/12/12	—	—	BRADFORD.	.. .. ..	Spark from taper for lighting gas.

C. CINEMATOGRAPH FILM STORES, ETC.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
17/9/06	—	—	LONDON.	Cinematograph apparatus & films.	Fire spread rapidly owing to films.
20/4/07	1	—	,,	.. .. ..	Cleaning films. Another film tenant in building.
22/11/07	1	—	WALTON-ON-THAMES.	Film producers.	Severe damage. Twenty-seven miles of film destroyed.
11/12/09	—	—	LONDON.	Film renters.	Considerable damage. Six Floors of mansions over.
3/3/10	—	—	,,	,,	Defective apparatus; film burned. Six floors of mansions over.
15/4/10	—	—	,,	,,	Severe damage. Six floors of mansions over.
17/5/11	—	4	,,	,,	Very severe damage. Six floors of mansions over. Several million feet of film destroyed.
17/6/11	—	—	,,	,,	Film in contact with electric light.
4/7/11	—	—	,,	,,	,, ,, ,,
24/7/11	—	—	,,	,,	Film-cleaning machine damaged.
25/11/11	—	—	,,	Apparatus & films.	Dark room damaged.
5/6/12	—	—	,,	Apparatus makers.	Oxygen apparatus exploded.
15/8/12	—	—	GLASGOW.	Film renters.	Spark whilst rewinding; severe fire; several other tenants.
18/9/12	—	3	LONDON.	School.	Goods in contact with electric lamp.
5/10/12	—	—	,,	Film renters.	Severe damage. Four floors of mansions over.
29/10/12	—	—	'	Dealer in old films.	Severe damage.

TABLES PREPARED FOR THE BRITISH FIRE PREVENTION COMMITTEE (RED BOOK NO. 179).

PLATE IV

SOME CELLULOID FIRES REPORTED AS OCCURRING IN THE UNITED KINGDOM.

(Fires notified to local authorities.)

D. CINEMATOGRAPH THEATRES.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	PLACE.	PARTICULARS.
2/10/97	—	Sev.	BRADFORD.	.. ..	Gas escaping from apparatus. Panic.
28/12/97	—	—	HUDDERSFIELD.	Infirmary.	Slight.
1/1/98	—	Sev.	BOLTON.	.. ..	Panic, and operator injured.
6/1/98	—	—	WOLVERHAMPTON.	.. ..	Slight. Film burnt out.
2/7/98	—	—	BILSTON.	Tent.	Slight panic, and tent overturned.
22/8/98	—	1	PENGE.	Tent.	Lamp fell. Operator burnt. Panic.
—/—/98	—	—	LONDON.	Church.	Film burnt in machine.
4/3/99	—	1	HAMMERSMITH.	.. ..	Films burnt in machine.
—/—/00	—	—	MILE END.	.. ..	Fire in Cinematograph chamber.
,,	—	—	LANGHAM PLACE.	.. ..	,, ,, ,,
—/—/01	—	—	EARL'S COURT.	Exhibition.	,, ,, ,,
,,	—	—	FULHAM.	.. ..	,, ,, ,,
—/—/02	—	—	LONDON	.. ..	Film in contact with resistance coil.
24/12/03	—	—	PRESTON.	.. ..	Film ignited.
—/12/03	—	—	NEWCASTLE-ON-TYNE.	Tent.	
5/12/04	—	Sev.	DUDLEY.	.. ..	Fire and panic.
26/12/04	—	Sev.	BELFAST.	.. ..	,, ,,
24/2/06	—	Sev.	SPENNYMORE.	.. ..	Films and machine destroyed. Panic
—/—/06	—	—	LONDON.	.. ..	Films in contact with flame.
20/9/06	1	—	GLASGOW.	.. ..	Film stopped in machine.
7/9/07	3	Sev.	NEWMARKET.	.. ..	Lime on film. Panic.
4/11/07	—	—	EDMONTON.	.. ..	No details, but panic.
5/11/07	—	—	GREENWICH.	.. ..	No damage outside chamber.
25/11/07	—	—	BIRMINGHAM.	.. ..	Very little damage owing to enclosure.
4/12/07	—	—	SKEWEN.	.. ..	No details, but panic.
4/3/08	—	—	N. SHIELDS	.. ..	Very little damage owing to enclosure, although theatre of wood.
30/3/08	—	—	WHITSTABLE.	.. ..	Films smouldered; no blaze; little panic.
5/8/08	—	—	GLASGOW.	Circus.	Little damage and panic.
—/9/08	—	—	MORECAMBE.	.. ..	Little damage; no panic.
14/11/08	—	—	CAMDEN TOWN.	.. ..	Only 2 films destroyed. Very little panic.
26/12/08	—	2	STRATFORD.	.. ..	Little damage; panic.
15/3/09	—	—	DARLINGTON.	.. ..	Little damage and panic.
1/5/09	—	—	HYDE.	.. ..	,,
11/5/09	—	—	ROCHDALE.	.. ..	Serious fire and panic.
14/8/09	1	—	SOUTHSEA	.. ..	Slight fire and severe panic.
18/8/09	—	—	SHEFFIELD.	.. ..	Little fire and panic.
30/8/09	—	—	DRURY LANE.	.. ..	,, ,,
—/10/09	—	—	MATLOCK.	.. ..	Lantern and films burned. No panic.
17/12/09	—	—	GLASGOW.	.. ..	Chamber partly destroyed.
27/3/11	—	—	MIDDLESBORO'.	.. ..	Spark from fan.
19/5/11	—	—	SELBY.	Portable.	Burnt out.
26/6/11	—	—	PORTSMOUTH.	.. ..	Operator's box burnt out; slight panic.
—/9/11	—	—	MANCHESTER.	.. ..	Cigarette in operating chamber.
23/9/11	—	—	HENLEY.	Tent.	Film ignited; fired tent; slight panic.
3/11/11	—	—	BOROUGH.	.. ..	Confined to operating chamber.
19/4/12	—	—	GLASGOW.	.. ..	,, ,, ,,
5/12/12	—	—	CAMBERWELL.	.. ..	Overrunning of machine. ,,
28/12/12	—	1	SLOUGH.	.. ..	Cigarette smoking in re-winding room.

TABLES PREPARED FOR THE BRITISH FIRE PREVENTION COMMITTEE (RED BOOK NO. 179).

PLATE V

SOME CELLULOID FIRES REPORTED AS OCCURRING IN FIVE CONTINENTAL CITIES.

(Fires notified to local authorities.)

A. CELLULOID WORKS.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
26/5/04	—	—	PARIS.	.. .. ..	Celluloid waste mixed with coal in factory.
15/1/05	—	—	,,	.. .. ..	Celluloid combs: slight fire.
28/11/05	—	—	,,	.. .. ..	Soldering a zinc box containing 20 kilogrammes of combs and jewellery for export.
12/10/06	—	—	,,	Making up celluloid.	Short circuit electric wiring.
15/11/06	1	Sev.	..	.. .. ..	Unauthorized celluloid depot.
11/1/07	—	—	..	.. .. ..	Employees making up celluloid too near the stove. Slight.
1/5/08	—	—	,,	.. .. ..	Soldering. Violent explosion. Probably due not so much to celluloid as to gases generated by it when burning.
9/9/08	—	—	,,	.. .. ..	Spark from buffing-wheel ignited dust and then some celluloid combs.
8/2/09	—	2	..	Fancy goods novelties factory.	Probably cigarette or match falling or thrown on paper wrapping. Very little celluloid. Serious fire.
15/10/09	—	—	..	.. .. ..	Slight fire in making-up shop.
—/—/10	—	1	..	.. .. ..	Making-up workshop. Woman throwing some celluloid cuttings into a stove.
16/1/02	—	—	BERLIN.	Warehouse.	Big box celluloid combs too near oven.
27/1/02	—	—	,,	Celluloid frame fac.	Spark from stove; goods near.
8/11/02	—	—	..	C. factory, Boxes.	?Careless light.
3/2/03	—	—	..	Factory.	Started in warehouse on 1st floor. Three floors burnt out. Cause unknown.
15/8/04	—	—	..	Metal goods fac.	Cause unknown.
3/9/04	—	—	..	Celluloid factory.	Unknown.
14/11/04	—	—	..	,,	Hot coals on celluloid goods lying near.
28/4/05	—	9	,,	Celluloid warehouse	Unknown: probably gas explosion.
25/5/05	—	—	..	..	Sparks from saws.
25/9/05	—	—	..	..	Roof and Contents burnt. Cause unknown.
1/3/06	—	—	..	Celluloid accuml'tr.	Cells. Unknown. (?) Short circuit.
23/10/06	—	—	..	Factory.	Celluloid shavings.
4/3/07	—	—	..	,,	Celluloid goods, also boxes and bookcases. (?) Spontaneous.
16/5/07	—	—	,,	,,	Careless warming of goods.
9/12/08	—	—	,,	,,	Box containing celluloid goods. Unknown: not given.
11/1/10	—	—	,,	,,	Celluloid boxes. Overheating of stove.
27/1/11	—	—	..	Accumulator fac'y.	Tables. Overheating of pitch.
9/5/11	—	—	..	.. .. ..	Boxes of celluloid goods. Heated petroleum lamp.
9/11/12	—	—	,,	Celluloid factory.	Spontaneous (?). Overheating of drying stove.
29/10/01	—	—	VIENNA.	Cell'd & fey. gds. fac.	Burnt out. Lighting gas; match.
17/2/03	—	—	..	Cell'd w'ks & dwg.	Lighting gas. Match on celluloid stacked on floor.
11/4/04	—	—	..	Celluloid workers.	Celluloid near piping of stove.
11/2/05	—	—	..	Celluloid turner.	Open light. Fire smothered out.
23/3/05	1	5	,,	.. .. ..	Electro-motor fire.
15/5/05	—	9	..	.. .. ..	Violent explosion. Burnt out. Cause unknown.
28/6/05	—	—	..	.. .. ..	Hot plate.
22/9/05	2	20	,,	.. .. ..	Polishing combs. Entire factory destroyed. Third celluloid explosion at this factory in this year. Girl of 16 looking for ring with match which fell into box containing 1 kilogramme celluloid scrap.
25/8/06	—	—	..	.. .. ..	Celluloid workers near gas light.
29/9/06	—	—	,,	.. .. ..	Dwelling and workroom burnt. Careless handling of light.
24/1/07	—	1	..	Comb factory.	Hot plate: bursting of heated oven. Owner severely burnt.
6/6/07	13	17	,,	.. .. ..	Third fire. Largest celluloid fire. 10 a.m. Smoking. Celluloid in cellar saved.
26/6/07	—	1	..	.. .. ..	Explosion. Celluloid shavings in cellar. Unlicensed. 3 Hydrants. Inhabitant jumped. (?) Spontaneous ignition.
16/7/07	—	—	,,	.. .. ..	Slight.
6/12/07	—	—	,,	.. .. ..	Celluloid spark from grinding wheel in sawdust.
30/12/07	—	—	,,	Cell'd & Wood t'nr.	Cause unknown.
10/3/09	—	—	..	.. .. ..	Shavings in box near stove. Cinders.
22/4/10	—	—	..	Cell'd accumulators.	Short circuit.
23/5/10	—	—	..	Cell'd brush m'k'rs.	Careless. Unguarded light.
13/7/10	—	—	,,	.. .. ..	Celluloid dust in workshop. Spark from grinding wheel.
4/3/11	—	1	,,	Comb workshop.	Burnt out. Learner badly burned. Careless lighting of lamp.
13/4/12	—	—	,,	.. .. ..	Hot plate. Box of celluloid. Fire went out itself.
22/5/08	—	—	HAMBURG.	Warehouse.	Box containing celluloid caught fire when being soldered.
31/12/08	—	—	,,	Storeroom.	Soldering a box containing celluloid. Fire spread to other articles as well as to part of building. Extinction rendered difficult owing to vapour.
15/4/10	2	—	..	Warehouse.	Soldering. Celluloid caught fire. Air mixing with vapour caused explosion: great force. Fire spread to 3rd floor and garret.
19/3/12	—	—	,,	.. .. ..	Soldering a box containing celluloid.
7/4/00	8	—	LEIPSIC.	Factory.	Explosion of petroleum lamp. Eight people suffocated.
10/1/01	—	—	,,	C. goods factory.	Glowing match dropped on celluloid shavings.
5/12/01	—	—	,,	Comb factory.	,, ,, ,, ,,
13/1/04	—	—	..	Celluloid factory.	Celluloid goods in box placed on stove.
31/12/04	—	—	..	C. goods factory.	During manufacture of celluloid with iron rasps. Sparks fire celluloid shavings.
3/4/05	—	—	,,	Workshop.	Celluloid paper too close to oven.
17/10/06	—	2	,,	Comb factory.	Sparks fell on celluloid shavings in course of manufacture.
7/12/07	—	—	..	C. goods factory.	,, ,, ,, ,,
23/5/08	—	—	..	Comb factory	Celluloid combs put to dry on stove. ,, ,,
21/1/09	—	—	..	C. goods factory.	Probably short circuit.
3/5/10	—	—	..	,, ,,	Celluloid heads put in oven to dry.
15/8/10	—	—	..	,, ,,	Heat from hydraulic press fires celluloid slab.
20/9/10	—	—	,,	Workroom.	Heat from gas ignites celluloid.
20/5/11	—	—	..	Photographic w'km	Overheating of oven ignites celluloid film.
18/12/11	—	—	..	Packing room.	Contents of lead box with celluloid compartments fired whilst soldering.
16/4/12	—	—	..	Foundry.	Sack of celluloid shavings placed on hot metal slab.

TABLES PREPARED FOR THE BRITISH FIRE PREVENTION COMMITTEE (RED BOOK NO. 179).

PLATE VI

SOME CELLULOID FIRES REPORTED AS OCCURRING IN FIVE CONTINENTAL CITIES.

(*Fires notified to local authorities.*)

B. CELLULOID IN SALE SHOPS.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
20/2/04	15	2	PARIS.	C. & Horn articles.	Celluloid being treated.
22/10/04	—	1	,,	Photographers.	Sweepings consisting of celluloid films put in stove.
26/4/09	—	5	,,	Commission agent.	Little damage and fire easily extinguished, but 5 people injured.
23/6/02	—	—	BERLIN.	Shop window.	Self-ignition.
1903	—	—	,,	C. goods shop.	Celluloid goods and cardboard boxes too near hot-water pipes.
15/12/09	—	—	,,	Shops.	Celluloid in shop. Carelessness with light.
19/5/04	—	—	VIENNA.	Hairdresser.	No details.
19/1/10	—	—	,,	Shop counter.	Explosion.
19/7/00	—	—	LEIPSIC.	Shop window.	Celluloid goods ignite from flame flickering in draught.
20/6/01	—	—	,,	.. .. ..	Framework of optical instruments fires from lamp used in soldering.
12/7/01	—	—	,,	Shop window.	Reflection of sun's rays by means of looking-glass on celluloid goods.
28/4/02	—	—	,,	,,	Sun's rays on celluloid goods.
11/12/02	—	—	,,	.. .. ..	Celluloid combs ignite from soldering lamp.
2/9/03	—	—	,,	Shop window.	Sun's rays on celluloid goods.
10/12/03	—	—	,,	Barber.	Flame of spirit lamp blown against celluloid comb.
7/4/04	—	—	,,	Shop window.	Reflected rays of sun on celluloid pins.
13/4/04	—	—	,,	Shop.	Celluloid film fires.
10/4/04	—	—	,,	Show case.	Sun's rays (probably reflected) on celluloid combs.
18/1/06	—	—	,,	.. .. ..	Celluloid comb on shelf over stove.
30/12/07	—	—	,,	Shop window.	Piece of burning match on celluloid goods.
28/2/08	—	—	,,	Barber.	Flame of lamp blown on celluloid goods.

C. CINEMATOGRAPH FILM STORES, ETC.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
8/10/04	—	1	PARIS.	.. .. ..	Cinematograph film. Man slightly burned.
16/5/08	—	—	,,	.. .. ..	Cinematograph film depot.
21/3/06	—	—	BERLIN.	.. .. ..	Cinematograph films in workshop.
23/5/11	—	—	,,	Film shop.	Films, boxes, tables. Unknown.
26/9/07	—	—	VIENNA.	Cinem. film exch'nge	2,000 m. films. Examining films, naked light.

D. CINEMATOGRAPH THEATRES.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
19/4/06	—	—	BERLIN.	Cinem. Theatre.	Spark arc lamp on film.
10/9/07	—	—	,,	,,	Roll film. Unknown.
3/11/07	—	—	,,	,,	Cupboard. Roll film. Spark from arc.
13/3/08	—	—	,,	,,	Roll film. Unknown.
2/1/09	—	—	,,	,,	Operating chamber. Rays of light.
7/7/09	—	—	,,	,,	Accident in dark room.
26/2/10	—	—	,,	,,	Film. Using an open light.
3/8/10	—	—	,,	,,	Film. Not known.
28/8/10	—	—	,,	,,	Film. Film stuck.
14/12/10	—	—	,,	,,	Film. Short circuit electric light in theatre itself.
15/12/10	—	—	,,	,,	Film burnt.
3/11/11	—	—	,,	,,	Two films in theatre. Spoilt film in window of operating room.
6/11/11	—	—	,,	,,	Cigar.
13/2/12	—	—	,,	,,	Film.
27/5/12	—	—	,,	,,	Careless operator.
11/8/12	—	—	,,	,,	Warmth of lantern.
27/8/12	—	—	,,	,,	Spark from arc.
10/9/12	—	—	,,	,,	,,
25/1/00	—	—	VIENNA.	,,	Films. No panic. Coliseum.
25/10/05	—	—	,,	,,	Spark from arc lamp on film.
18/2/06	—	—	,,	,,	Short circuit. Film fired.
25/2/06	—	—	,,	,,	No details.
11/11/06	—	—	,,	,,	,,
23/2/07	—	—	,,	½	80 m. film. Careless putting out of light.
15/11/07	—	1	,,	,,	Shutter not closed. Operator slightly burned.
,,	—	—	,,	Cinem. Theatre.	After performance. Careless handling of naked light.
23/4/09	—	—	,,	,,	Film broken.
?	—	—	,,	,,	Slight. Film on hot lens.
3/12/09	—	—	,,	,,	Film stuck in gate.
8/12/12	—	—	,,	,,	Gate.
24/5/08	—	—	LEIPSIC.	Operating room.	Electric sparks fire films which are being inserted; 2 rolls burnt.
1/10/08	—	—	,,	,,	Too long exposure of film to light.
3/2/09	—	—	,,	,,	,, ,, ,,
5/5/09	—	—	,,	,,	,, ,, ,,
8/5/09	—	—	,,	,,	Cause not given.
24/11/09	—	—	,,	,,	Ceiling pipe catches fire and burning pieces of wood ignite film.
27/4/11	—	—	,,	,,	Heat of electric radiator on film.
17/6/11	—	—	,,	,,	Too prolonged exposure of film.
23/7/11	—	1	,,	,,	Short circuit: film fires. Operator slightly burnt.
11/9/11	—	—	,,	Theatre.	Match on film.
24/3/12	—	—	,,	Operating room.	In tearing film torn end is left too long exposed.

Note.—No Particulars of Fires in Cinematograph Theatres in Paris and Hamburg are to hand.

TABLES PREPARED FOR THE BRITISH FIRE PREVENTION COMMITTEE (RED BOOK NO. 179).

PLATE VII

SELECTED CELLULOID FIRES REPORTED OCCURRING IN THE UNITED STATES OF AMERICA.

(NEW YORK STATE, NEW JERSEY AND MASS. ONLY).

A. CELLULOID WORKS.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	PARTICULARS AND CAUSE.
28/7/92	1	—	SPRINGFIELD, N.J.	Celluloid Articles.	Destroyed whole works.
4/9/98	—	—	NEWARK, N.J.	Comb Factory.	Stores of celluloid and scrap.
—/—/98	—	—	LEOMINSTER, MS.	,,	Caul box.
10/10/00	—	—	NEW YORK.	,,	Match in scrap. 1,500 lbs.
10/5/01	—	—	NEWARK, N.J.	Novelty Factory.	Hot lead ignited scrap in sack.
23/5/01	—	—	ATTLEBORO, MS.	Comb Factory.	Scrap under bench.
29/9/01	—	—	LEOMINSTER, MS.	,,	Celluloid on steam table.
?	—	—	,,	Novelty Factory.	Drying or Ageing. 40,000 lbs.
25/6/03	—	—	,,	Comb Factory.	Combs on bench.
14/12/03	—	—	,,	,,	Three floors. Steam pipes in packing. 15 tons.
7/3/04	—	—	NEWBURY PORT, MS.	Celluloid Factory.	Two floors. Strong nitric acid firing bench and extending. 30 Tons.
9/6/04	—	—	WEST SOMERVILLE, MS	Comb Factory.	Spark from saw. 300 lbs.
?	—	—	LEOMINSTER, MS.	,,	Drying closet.
?	—	—	,,	,,	Electric lamp on combs.
19/11/04	—	—	NEW YORK	,,	Sand-papering. 1,200 lbs.
?	—	—	,,	,,	Spark from burning machine: no dust extractor.
23/6/05	—	—	NEWARK, N.J.	The Celluloid Co.	Novelties. 65,000 lbs. in store.
31/7/06	Sev.	—	,,	Soluble Cotton Fac.	Drying room. Men killed.
21/11/06	—	—	NEW YORK.	Comb Factory.	Five floors and several tenants. Paraffin lamp.
16/4/07	—	—	BOSTON, MS.	,, ,,	Coopering loaded casks of scrap.
9/7/07	—	—	LEOMINSTER, MS.	Comb Factory.	Stock overheated.
10/7/07	—	—	NEWARK, N.J.	,,	Spark in breaker.
12/8/07	—	—	NEWBURY PORT, MS.	,,	Blanks on steam table.
8/3/08	—	—	SPRINGFIELD, MS.	Fibreroid (similar to Celluloid).	Celluloid in process of manufacture. Probably pyroxylin, insufficiently washed.
—/9/08	—	—	LEOMINSTER, MS.	Comb Factory.	Burrer spark into dust. No blower.
19/10/08	—	—	IND. ORCHARD, MS.	Celluloid manufacturing.	Breaker.
—/11/08	2	—	NEW YORK.	?	Two men killed.
2/12/08	—	—	LEOMINSTER, MS.	Comb Factory.	Shaping machine.
29/1/09	—	—	NEWBURY PORT, MS.	Comb Factory.	Stock on steam table. 400 lbs.
12/8/09	—	—	LEOMINSTER, MS.	Manufacturing.	Scrap upset in motor lorry and ignited, and spread to warehouse.
24/8/09	—	—	ROCHESTER, N.Y.	Novelty.	Drying roo n. No sprinklers.
14/10/09	—	—	?	Celluloid articles.	Unknown.
8/11/09	9	—	BROOKLYN, N.Y.	Comb.	?Smoking. Nine lives lost. 500 lbs.
—	—	—	?	Comb and novelty.	Six floors, other tenants. Spark from switch. Four burned.
—	—	—	?	Hair ornaments.	Pin dropped through netting on to steam pipe in drying room
—	—	—	?	Comb.	Left on steam table. Extinguished by pail of water.
7/7/11	—	—	?	Novelties.	Very hot summer.

SOME FIRES OCCURRING TO CELLULOID IN TRANSIT

DATE.	LIVES LOST	LIVES INJ.	TOWN.		CAUSE AND PARTICULARS.
19/9/06	—	—	NEW BRIDGE.	Carrier's Depot	Fire in cases containing celluloid accumulator cells.
10/1/08	—	3	LONDON.	S.S. in Thames.	Oil lamp upset; 25 sacks of celluloid shavings (each about 50 lbs.) destroyed. Mast, rigging and part of ship by fire and heat.
13/11/08	—	—	LOGANSPORT, IND.	Train.	Package of Pyroxylin Plastics consisting of combs, hairpins, etc. Probably ignition from steam pipes.
6/8/09	3	1	LA GARONNE-BEZONS (SEINE).	Cart.	Six cases made of deal boards loosely nailed together containing in all 620 kilogrammes of scrap celluloid—really old cinematograph films loose. Carman taking them away: four cases inside cart—two outside. Celluloid flared up just as cart was starting.
13/3/09	—	1	BELVUE, KANSAS.	,,	Two boxes of cinematograph films in train. Probably too near steam pipes. Whole car destroyed.
14/1/10	—	—	PITCAIRN, PA.	,,	Package containing Pyroxylin goods, fancy hat-pins and other novelties wrapped in cotton destroyed. Probably spontaneous combustion.
21/2/11	—	—	CINCINNATI.	Carrier'sDepot	Cardboard box containing fountain pens and watch cases left at parcels office for transmission. Only 1 pen consumed. Investigated at Laboratory, cause given: spontaneous combustion.
5/2/12	—	—	ERNESTOWN, CANADA.	,,	Celluloid combs stored in cardboard box: placed too near steam pipe in train.
8/8/12	—	—	CHICAGO.	Cart.	Package containing 3 reels of cinematograph films fired whilst being loaded on to a cart. Probably the box was defective, admitting spark or fire accidentally.

PLATE VIII

SELECTED CELLULOID FIRES OF AN EXCEPTIONAL CHARACTER OR OF TECHNICAL INTEREST OCCURRING ELSEWHERE.

A. CELLULOID WORKS.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
1/4/04	—	—	S. PETERSBURG.	Celluloid Factory.	Explosion. Very serious damage.
14/11/06	1	4	BANK.	Celluloid Factory.	Fire occurred in kneading machine, rolling room burnt out.
12/1/07	21	—	GEISPOLSHEIM (in Strasburg).	.. ..	Spark from stove into basket of celluloid waste.
—/9/08	3	Sev.	EILENBRUCH.	,,	Poisonous gases formed with curious effects. Eyes of one man protruded violently from his head. Others felt ill after being at home 6 hours after fire. Several had headache and sore throats although only spending 3 or 4 minutes in room where fire was.
14/1/11	—	—	NAUMBERG.	.. ..	Soldering up case containing celluloid: Whole building damaged; dwelling portion gutted and workshop wrecked.

B. CELLULOID IN SALE SHOPS.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	CAUSE AND PARTICULARS.
24/8/03	12	16	BUDAPEST.	The Parisien Store.	Fusing electric light wire (?). Large drapery store with quantities of celluloid.

C. CINEMATOGRAPH FILM STORES, ETC.

DATE.	LIVES LOST	LIVES INJ.	TOWN.	TRADE.	PARTICULARS.
27/9/09	—	—	PITTSBURG.	. .	Defective electric lamp. Film in vault fired, thrown out and spread to rewinding room. Explosion resulted. (*See Special Report in Appendix II.*)
2/7/10	—	—	NEW YORK.	. .	Probably caused by defective electric light switch. Fire rapid. No explosion as films not tightly enclosed. Building 12 floors high. Films on 2nd floor. Damage to upper floors through windows.
5/9/10	2	—	?	.. ..	Factory. Fire started in yard where sorting old film was being done and spread to a vault with open door. An adjoining vault not damaged due to fire-resisting glazing, etc.
?	—	—	?	. .	Bursting of incandescent electric lamp and parts coming into contact with film in examining room. Very rapid and fierce fire; no explosion. Sprinklers held fire in check.

D. CINEMATOGRAPH THEATRES.

DATE.	LIVES LOST	LIVES INJ.	COUNTRY.	TOWN.	PARTICULARS.
14/1/08	169	—	U.S.A.	PENNSYLVANIA.	Cinematograpb exhibition in progress; fire not due to same. Panic.
26/8/11	26	—		PITTSBURG.	Smoke panic.
—/—/07	—	150	GERMANY.	KOSTENTLATT.	Film fired; panic.
3/8/08	1	—	ITALY.	POLIGNANO.	Panic.
18/10/08	—	—	FRANCE.	LUNEVILLE.	Building gutted.
14/2/09	200	—	MEXICO.	ACAPULCO.	Film fired. Building of wood.
21/2/09	4	—	RUSSIA.	TULA.	
—/7/09	—	60	GERMANY.	DRESDEN.	Extended to 128 booths, 2 circuses, 2 concert halls, 233 booths of a " Fair."
5/3/11	90	—	RUSSIA.	BOLOGOE.	
7/3/11	Sev.	50	PORTUGAL.	ABRANTES.	
27/5/12	65	66	SPAIN.	VILLARREAL.	Film fired and fell on unrolled film.
—/7/12	—	—	FRANCE.	TARAXON.	Moth with burning wings flew on to film.
23/9/12	3	—	S. AFRICA.	CAPE TOWN.	No fire, but panic.
25/11/12	46	—	SPAIN.	BILBAO.	False alarm, but panic.

TABLES PREPARED FOR THE BRITISH FIRE PREVENTION COMMITTEE (RED BOOK No. 179).

PART II.
THE REMEDY.

IV. THE EXTINGUISHING OF CELLULOID FIRES.

As has already been stated this Committee has carried out many tests and during the last six years it has made a considerable number with various kinds of Chemical Fire Extinguishers and other appliances. Each extinguisher, etc., has been subjected to at least one test to show its efficiency or otherwise in dealing with Celluloid fires.

With this purpose in view a small heap of Celluloid scrap and dust—about 2 feet in diameter and 1 foot high, weighing about 10 lbs.—has been placed in a testing hut and ignited with a standard torch. After the Celluloid has been allowed to burn for five seconds the extinguisher, etc., has been applied.

The following table has been compiled from the various Red Books issued by this Committee detailing the results of the different tests.

Red Book:	*Capacity of Extinguisher:*	*No. Used:*	*Fire out in:*	*Résumé of Result:*
LIQUID CHEMICAL EXTINGUISHERS.				
121	10 pints	1	33 secs.	Practically *all* consumed.
124	16 pints	1	20 secs.	Quantity *not* consumed.
126	24 pints	1	25 secs.	Very small quantity *not* consumed
134	18 pints	1	36 secs.	About one-fifth *not* consumed.
142	$8\frac{3}{4}$ pints	1	24 secs.	Very fair quantity *not* consumed.
152	$10\frac{1}{2}$ pints	1	50 secs.	Very fair quantity *not* consumed.
161	$1\frac{2}{3}$ pints	2 (2 operators)	18 secs.	Very little *not* consumed.
165	26 pints	1	25 sees.	About one-fourth *not* consumed.
177	16 pints	1	$17\frac{1}{2}$ secs.	Small quantity *not* consumed.
POWDER EXTINGUISHERS.				
115	5 lbs.	4	—	*All* consumed.
127	3 lbs.	4	27 secs.	Small quantity *not* consumed.
ASBESTOS CLOTHS.				
133	—	3 (2 operators)	45 secs.	*All* consumed.
ORDINARY PAILS OF WATER.				
128	15 pints	3	12 secs.	Very small quantity was consumed.

Based upon these tests and upon general experience this Committee does not consider any of the small liquid chemical extinguishers submitted to them for test sufficiently efficient or reliable in dealing with small Celluloid fires in even early stages, to recommend their being installed, although these appliances as a class may, if in good order and properly handled, sometimes check such small Celluloid fires.

Powder extinguishers which are unreliable as a class requiring exceptional skill and practice to handle are entirely unsuitable for this class of fire.

Asbestos cloths are also entirely unsuitable to this class of fire.

Ordinary pails of water proved very effective.

After careful consideration this Committee strongly recommends that a plentiful supply of buckets of water be provided in easily accessible positions in all premises where Celluloid in any form is manipulated or stored.

Hydrants and hose should be provided. A rising 4 inch main, with good pressure of water, should be installed in the staircase, with a 3 inch main running the length of each floor and a full sized hydrant and length of hose (flaked) sufficient to command the floor taken off same near the exits. In addition at frequent intervals small hydrants taken off the same 3 inch main, and with 20 or 30 ft. lengths of hose, should be provided.

The installing of Automatic Sprinklers which, from the Statistics regarding fires in Celluloid works in the United States, appear to be effective in extinguishing or keeping under control numerous fires when of small extent, is also recommended.

Another recommendation is that open metal bins (with drop down hinged lids) available for throwing in burning Celluloid should be provided in factories and other premises (including Theatres) where Celluloid or Cinematograph films are handled.

A further point to be noted is that in the S. R. and O., 1910, No. 189, issued in connexion with the Cinematograph Act, 1909, regulation 4 stipulates that "a damp blanket" must be provided. A case is on record where the blanket when being used on a large quantity of burning film proved to be of *flannelette!* Thus the description of blanket requires definition by regulation.

V. WARNINGS AS TO CELLULOID.

The British Fire Prevention Committee considers that the dangers of Celluloid are as yet not properly appreciated either by (a) the general public, (b) vendors of Celluloid and their employees, (c) the manipulators or workers in Celluloid, more especially by those coming under the first two headings.

As far as the general public is concerned, this Committee urges the advisability of general public warnings being issued from time to time by local authorities, as it is satisfied that the public welcome warnings and cautions, particularly if expressed in simple language and in an easily readable form.

Up to the present no specific warnings as to Celluloid have been issued, but in other general warnings some of these celluloid dangers have been referred to.

Report No. 158 dealt with the Committee's fire preventive work by means of warnings and cautions on the occasion of the Coronation celebrations on June 22 and 23, 1911, the results of which were generally recognized as being of a most remarkable character, and in respect to which it has had indications of the appreciation of all the authorities concerned.

This work of issuing warnings and cautions included the posting of 14,000 bills, 4,000 letters to occupiers on the routes of the processions, and 5,000 slips; communications were also issued to 400 newspapers, with a total circulation of about 8,000,000.

As to the result of this work, the Committee considers it is best to let the London Fire Brigade reports, Police, and Ambulance reports speak for themselves. There was only one fire attended by the Fire Brigade on the routes of the processions on the 22nd and 23rd and that in Pall Mall, and the total number of fires in the county of London on the two days in any way attributable to the celebrations was eleven, for the most part due to illuminations: a few cases of small fires were reported where draperies and decorations caught alight and were dealt with without notifying the brigade. There were a few records of slight burns owing to dresses catching fire, but no case of personal injury or death from fire among the crowds.

The effect of the warnings against smoking was most marked; at 12 noon on the 22nd only 17 people were noticed smoking between Waterloo Place and Marlborough House on the south side of Pall Mall, and at 1.15 p.m. only 23.

The warnings in question included the following references to Celluloid:

RE MATCHES, SMOKING, AND WEARING APPAREL.

"Celluloid articles should on no account be worn."

RE DECORATIONS, ETC.

"Celluloid decorations should be avoided."

At Christmas, 1912, the Committee issued a warning in respect to Christmas parties, festivities and decorations in order to reduce the very large number of fires that have generally occurred in England between December 23 and 30. Over 20,000 posters and handbills were issued, largely with the co-operation of the police, county constabulary, corps of commissionaires, boy scouts and other organizations. Over 300 newspapers with large circulations printed these cautions and warnings and dealt with them editorially.

Although systematic inquiry has been made throughout the country as to cases of fires, scarcely any have been found in England, the territory dealt with, and none of these were serious or caused a single fatality.

Large numbers of institutions ask to be supplied with such warnings in appreciation of the risk.

The Christmas warnings in question included the following reference to Celluloid:

> "*Celluloid*, being a highly inflammable material, should not be used on Christmas trees or in decorative schemes."

This Committee also supplies to a limited number of industrial subscribers warnings and cautions in respect to the conduct of their manufactures or trades, which circulars are also brought to the notice of H.M. Inspectors of Factories for use at their discretion.

At the same time it is felt that such warnings should be issued officially to traders in respect to special risks of fire and Celluloid in particular, because if such cautions were systematically issued and repeated at intervals, the common knowledge as to the dangers of Celluloid would increase, and necessary precautions would be taken by a very large proportion of the general public, the dealers and the manufacturers.

VI. THE MARKING OF CELLULOID.

Without doubt one of the easiest solutions to some of the Celluloid dangers would be the compulsory marking of (a) all Celluloid articles with the word "Celluloid" where such articles have a greater superficial area than 2 sq. in., and (b) all boxes, cardings, and the like on which Celluloid articles are attached or in which they are packed, so that there should not be the slightest possibility of a purchaser not plainly recognizing that the goods purchased were made of Celluloid.

Small articles such as combs, buttonhooks, brushes, buckles and the like, are even now marked with the name of the maker or with the country of origin, and it cannot be any hardship to the trade if the word "Celluloid" were marked on the goods in a similar manner.

At the same time it is not necessary to handicap the trade by further adding the word "inflammable" or "dangerous," actually on the product, but it might be advisable to add the word "dangerous" or "inflammable" to all packages, cardings and labels in a somewhat similar manner to that provided by legislation for poisonous and other dangerous products.

Further, it should be made compulsory that all Celluloid articles in transit, or in cases, should have plainly marked on the wrappings or cases the words "Celluloid" with the addition of the word "inflammable" or "dangerous."

VII. LEGISLATION AS TO CELLULOID.

The British Fire Prevention Committee considers that fresh legislation is necessary as a safeguard against the dangers of Celluloid.

Such new legislation should apply to the whole of the country, and it should take the form of an enactment giving certain local authorities powers to grant licences to the owners, or occupiers, of the premises concerned, subject to regulations issued by (or approved by) the Secretary of State. The system of license, however, need not be applied to:

[a] Manufacturers and manipulators of celluloid goods who have less than 224 lbs. of Celluloid on their premises.

[b] Dealers in Celluloid goods who have less than 560 lbs. on their premises.

[c] Celluloid film dealers or renters having less than 224 lbs. of celluloid film on their premises.

And where less quantities than the above are on the premises a system of registration, combined with regulations, would suffice.

All premises where not more than 15 lbs. of either Celluloid, manufactured or unmanufactured, are kept should be excluded from all regulations and registration, and the same exemption should apply to premises where less than 15 lbs. of cinematograph films are kept, provided each film is kept in a metal box, such exemptions pre-supposing the marking of Celluloid and regulations as to transit.

This enactment should provide general powers to make regulations (a) as to the marking and recognition of Celluloid, with a definition as to what materials come within the term Celluloid, (b) as to the manufacture, manipulation and dealing in Celluloid goods or goods of which Celluloid forms a part, including some system of registration, (c) as to the transit of Celluloid in any form, and (d) that these regulations should be administered by the local authority.

Regarding the central administration, the enactment being essentially a fire preventive measure, the framing of the regulations appears to be within the scope and province of the Home Office, whose measures on fire preventive subjects enjoy general confidence, whilst for local administration any lesser authority than the County Council (with certain limited rights to delegate their duties) would be undesirable.

As it sometimes happens that the local authorities do not always diligently enforce the powers and duties imposed on them by Act of Parliament, a clause should be inserted giving the Secretary of State power to appoint, in case of default, a person to exercise the powers of the Act concurrently with any authority, and at that authority's expense.

It would also be advisable that all places where Celluloid is actually made from nitro-cellulose should be conducted under the Explosives Act, 1875, and failing the immediate application of that Act that there be a specific clause in any new enactment that the Explosives Act be so applied.

Regarding the regulations which should be made under a

new enactment, there should be a clear discrimination between (a) Manufacturers, including those who conduct any form of manipulating, carding, and the like, and (b) Cinematograph Film Dealers and Renters and (c) all other Dealers, including retail and wholesale premises and warehouses and stores. The Act should give wide powers as to entering for inspection and the taking of samples. It seems also advisable that the process for enforcing the enactment should be of a summary character.

The Metropolitan Police in their regulations for *Motor Omnibuses* stipulate under Rule 45 that:

> No Celluloid or Xylonite fittings to be placed inside or outside, but this does not apply to the inside of accumulators.

and for *Motor Hackney Carriages* stipulate in addition to Rule No. 45 as above under Rule 26 that:

> Straps with holes must be placed on the window frames (where considered necessary) and *metal* or *bone knobs* must be fixed inside the carriage to enable the windows to be partially closed.

Regarding Transit and Packing, the Explosives Act, 1875, provides for the conveyance of all "explosives," including nitro compounds.

The different Railway Companies in this country have also issued special regulations for the conveyance of Celluloid scrap, Xylonite scrap (dust, shavings and pieces), as follows:

> Packages must be labelled in conspicuous characters "Celluloid Scrap, Inflammable," and must not be stored in the railway company's enclosed sheds or warehouses. The goods must be packed "in sound wooden packages."

Xylonite solution, Xylonite thinnings, and Xylonite paste are also provided for by somewhat similar conditions.

Post Office Regulations.—Under the heading of Foreign and Colonial Parcel Post the following instructions appear in the "Postal Guide":

> Packing and Sealing.—*Celluloid* unmanufactured or in sheets must be well packed in strong wooden boxes, and articles composed wholly or partly of celluloid must be in a packing not less strong than stout cardboard, and a white label bearing the word "Celluloid" in plain black letters should be affixed to the parcel, and to the Dispatch-note when one is used. Liquid celluloid cannot be sent by post.

Cinematograph films should never be conveyed from place to place either by hand or vehicle except in strong iron cases.

In view of the serious fires which have occurred through soldering the metal linings of packing cases containing celluloid goods a regulation should be included.

Several cities and towns in this country have issued regulations and suggestions for the prevention of fire in places where Celluloid is manipulated. Amongst these may be mentioned the Corporation of the City of London in July, 1907, and more recently the City of Birmingham, and it is felt that pending the issue of regulations certain suggestions should be published by the Secretary of State.

The Committee has studied several of the existing regulations of Europe and the United States of America, and has come to the conclusion that no one entire Act or set of Regulations of any country could be made applicable to this country.

Amongst others the following regulations have been examined:

France. Napoleon's Code, October 15, 1810, dealing with premises where dangerous goods are kept, etc., and the various classification orders subsequently issued in connexion therewith.

The order, May 27, 1904, with regulations for shops and stores where Celluloid is kept, in Paris.

Germany. Regulations for premises where Celluloid goods are made and stored, issued May 7, 1910.

Regulations for Celluloid in transit, issued December 11, 1911.

Austria. Regulations for premises where Celluloid goods are made and stored, issued July 15, 1908.

United States. The Rules of the National Board of Fire Underwriters: 1. Governing the Storage and Handling of Nitro-Cellulose films. 2. Governing the Storage and Handling of Nitro-Cellulose products.

The Newark Fire Prevention Code.
The City of Philadelphia Regulations.
The Massachusetts State Laws.

But most of the regulations contain certain features that are applicable to this country, and the British Fire Prevention Committee has framed the following suggestions as indicating the safeguards it recommends:

REGULATIONS

for dealers in and manufacturers of:

(1) *Articles* made wholly or partly of Celluloid or Nitro-Cellulose combined with camphor, and other materials and hereinafter referred to as Celluloid articles.

(2) *Cinematograph films* in so far as the Cinematograph Act, 1909, does not apply, and also excluding those films passing the "Non-flaming" standard set forth below. These regulations are not to apply to film producers provided not more than 15 lbs. of Cinematograph film are kept on the premises at any one time and the films are not sensitised, developed, printed, or otherwise manipulated but only exposed in the camera.

DEALERS.

Dealers (i.e. all classes of shopkeepers, wholesale merchants, warehousemen, etc.), excluding such premises where not more than

15 lbs. of Celluloid material, whether manufactured or not, is to be found.

Celluloid articles, but not including Cinematograph films, can only be kept for sale or stored in a "*domestic building*" or a "*building of the warehouse class*" as defined in the London Building Act, 1894, sec. 5, 26 and 28, in the following manner:

Under 56 *lbs.* must be kept in a properly closed box, cupboard, or other receptacle that will protect them from accident from fire, and if any Celluloid articles are exposed for sale or sold they must be in a substantial approved case and must be conspicuously labelled "Celluloid—Dangerous."

Fire-Resisting glazing permitted in such receptacles.

Nothing else must be in the receptacle or case with these Celluloid articles.

No artificial light allowed in such receptacle.

No highly inflammable article must be near the receptacle and precautions must be used to prevent accident.

Any amount *over and above* 56 *lbs.* of Celluloid articles must be kept in a store built of fire-resisting materials (*vide* London Building Acts (Amendment) Act, 1905, First Schedule).

The store to be ventilated direct to the open.

No internal artificial light allowed. Artificial illumination to be obtained by means of lights outside the store shining through double fire-resisting glazing of limited area.

No artificial heat allowed in said store.

Such store must be kept securely fastened and nothing besides the Celluloid articles may be kept in it.

Inflammable articles or liquids must not be kept near the store, and precautions against accident must be observed.

If more than 560 *lbs.* of Celluloid articles are to be kept, a special licence with specified conditions in detail must be obtained.

These regulations apply only to premises where Celluloid articles are *not manufactured* nor manipulated in any way. If any trade process is carried on the undermentioned regulations must be observed.

Note: For regulations for premises where Cinematograph films can be kept or manipulated see next section, except that a quantity not exceeding 15 lb. may be kept in a Dealer's premises provided they are not exposed for sale and each film is in a separate metal box.

Packing.—If Celluloid, either goods or scrap, are packed for transit in wooden boxes with zinc linings the soldering must only be done with a moderately warm soldering iron (not a soldering lamp), and immediately under the zinc where the soldering is to be done and covering the whole of the Celluloid goods or scrap must be placed a sheet of asbestos or some similar fire-resisting material.

MANUFACTURERS.

Manufacturers (including fabricating, assembling, carding, boxing, spraying, manipulating in any form). Regulations for premises where any hands and/or learners are employed in working on, in handling or storing Celluloid or Nitro-Cellulose combined with camphor, products, and Cinematograph films, including Film dealers and Renters, but excluding such premises where not more than 15 lb. of Celluloid material, whether manufactured or not, other than Cinematograph films, is to be found at any one time.

If the quantity at any one time in any manufacturer's premises exceeds 224 lbs. a special licence with specified conditions must be obtained.

PACKING.—If Celluloid, either goods or scrap, or Cinematograph films are packed for transit in wooden boxes with zinc linings the soldering must only be done with a moderately warm soldering iron (not a soldering lamp), and immediately under the zinc where the soldering is to be done and covering the whole of the Celluloid goods or scrap must be placed a sheet of asbestos or some similar fire-resisting material.

I. *Position and Structure of the Rooms.*
II. *Internal Equipment and Arrangement of the Rooms.*
III. *Working Regulations.*
IV.. *Additional Regulations applicable to Premises in which Cinematograph Films are Stored and Handled.*

I. *POSITION AND STRUCTURE OF THE ROOMS.*

A. *No part* of any building in which Celluloid or Nitro-Cellulose combined with camphor, products and Cinematograph films are worked or stored may be *occupied for human habitation.*

B. *Each workroom* must be provided with *two exits* on different sides from which *fire-resisting stairs* (*vide* London Building Act, 1894, sec. 68, and London Building Acts (Amendment) Act, 1905, First Schedule) can be reached.

C. The *workrooms or stores* must have all *walls, floors and ceilings of fire-resisting materials* (as above defined).

The doors must open outwards and close automatically.

Any *lifts or openings* between floors must be constructed in a similar manner as stairs.

Store rooms for raw Celluloid and Nitro-Cellulose combined with camphor, products, finished and unfinished goods, waste and solvents in connexion with premises coming under these regulations must be separated from the workrooms by fire-resisting walls passing up to and through the roof at every point without any openings therein.

II. *INTERNAL EQUIPMENT AND ARRANGEMENT OF THE ROOMS.*

A. *Ventilation*..The workrooms must have at least 500 c. ft. of air space for each person and be provided with ample natural ventilation. The windows must have large panes of thin glass (not wired) and the entire window space of each workroom must be at least 15 per cent of the floor area and 40 per cent of the window wall. The vapours of any liquid solvent must be effectively removed.

B. *Heating.* Low-pressure steam or low-pressure hot water pipes or hot air obtained by passing air over low-pressure steam or low-pressure hot water pipes only allowed. The furnace in connexion therewith to be in a bricked-off compartment with fire-resisting door closing automatically. No Celluloid or Cinematograph film in any condition to be allowed in said compartment.

C. *Lighting.* Incandescent electric light only allowed, the lamp to be protected by a glass globe and in the case of portable extensions either a glass cover or a metal frame to prevent the lamp being brought into contact with any Celluloid, the main controlling switch for each store and/or workroom to be outside the store

and/or workroom. The whole of the electric installation to be strictly in accordance with the Rules of the Institution of Electrical Engineers.

If electric current from outside mains is not available a gas or oil engine may be installed to generate current provided it and the dynamo are placed in a bricked-off compartment with a fire-resisting door closing automatically. No Celluloid or Cinematograph films in any condition allowed to be stored therein.

D. *Machinery* to be electrically driven if other than manual or treadle power required, the whole installation to be strictly in accordance with the rules of the I.E.E.

If electric current from outside mains is not available arrangements as detailed under the last section must be adopted.

E. *Extinguishing Devices.* At least 12 *buckets* (each of two Imperial gallons capacity) kept full of water must be provided in each workroom, and 4 for each additional 250 sq. ft. or part thereof, after the first 750 sq. ft.

Hydrant and Hose. A hydrant to be fitted on to each floor of each building with sufficient length of hose to command the floor. All fittings to be of the same size and standard as that of the local fire brigade. (See also page 18).

Automatic Sprinklers. To be fitted throughout the whole of any buildings wholly or partly occupied by any firm whose premises come under these regulations. The installation to be erected and maintained strictly in accordance with specified standards and approved water supplies.

Automatic Fire Alarms. To be installed in all buildings in more than one tenure. The installation to be erected and maintained strictly in accordance with specified standards.

No Chemical fire extinguisher or Hand Grenade may be substituted for any of the above appliances. All the appliances to be inspected regularly and any defects made good—the buckets once a week and the hydrants and hose every two months.

III. *WORKING REGULATIONS.*

A. *Smoking and Matches.* No smoking allowed. No one to be allowed to enter any of the stores or workrooms with matches upon their person. Regulations to this effect are to be exhibited on the outer side of all doors.

B. *Passages and Communications.* All gangways and passages must be kept permanently clear of every kind of article. They must not be less than 3 ft. 6 in. wide and must as far as practicable lead straight to the two principal exits.

C. *Storage of Material and Waste.* In the workrooms only sufficient unmanufactured stock raw material for one day's requirements and finished articles to the amount of one day's production allowed at any one time. *Small waste, chips,* etc., produced by machinery or hand work must be caught if possible in *metal vessels* containing water. The latter must, when not in use or in case of danger, be closed with a metal cover and emptied twice a day into metal bins specially kept for this purpose in a store room (see I., C). *Sawdust and dust* from buffing and grinding wheels must be *exhausted* through metal ducts into metal vessels or collectors situated, if possible, detached from the workshop, otherwise they must be in bricked-off compartments, and so arranged that the whole of the dust, etc., is under water. The collectors to be emptied at least twice a week

and the contents put into the abovementioned special bins in a store room. The fans for the exhausting apparatus to be near the dust, etc., vessels or collectors. No other waste (such as paper, etc.) to be put in any Celluloid or Cinematograph film waste bin.

D. *Solvent or Cement.* Maximum quantity to be limited to $\frac{1}{4}$ pint for each person at any one time in one workroom. The stock to be kept in a securely stopped metal can, and that in use in approved Economisers.

E. *Keeping Rooms Clean.* The workrooms must be kept clean and floors and walls and ceilings swept daily, employing moist sweeping.

IV. ADDITIONAL *REGULATIONS APPLICABLE TO PREMISES IN WHICH CINEMATOGRAPH FILMS ARE STORED AND/OR HANDLED AND/OR PRODUCED.*

Not applying to those films passing the "Non-flaming" standard set forth below nor to film producers where not more than 15 lbs. of Cinematograph film are kept on the premises at any one time and the films are not sensitized, developed, printed, or otherwise manipulated but only exposed in the camera. Nor to those Dealer's premises where a quantity not exceeding 15 lbs. is kept at any one time and the films are not exposed for sale and each is kept in a separate metal box.

A. *Films. Each reel* of film to be kept in a separate *metal box* with tight-fitting cover, except when actually being examined or repaired.

B. *Store Rooms.* Films must be kept in vaults of fire-resisting construction (as above defined) of a capacity not exceeding 750 c. ft. The door to be smoke-proof and the fixtures inside the vault of incombustible material.

C. *Ventilation of Vaults.* Vaults to be ventilated to the outside air by an opening having a sectional area of at least 50 sq. inches (if the size of the vault is less than 150 c. ft. the vent may have a sectional area of 12 sq. inches). Vent pipes to be of metal not less than No. 18 B.W.G. in thickness and not soldered; not to be a source of exposure to other property, to be shielded from the weather and provided with a wire screen of not larger than $\frac{1}{4}$-in. mesh.

D. *Examining, Rewinding and Repairing.* To be done only in rooms used for no other purpose and in which no films are stored. Not more than 10 reels of films to be under examination, rewinding or repair at any one time. Such reels of films to be enclosed in metal spool boxes of substantial construction made to close in such a manner and fitted with a film-slot so constructed as to prevent the passage of flame to the interior of the box.

If the quantity at any one time exceeds 224 lbs. a special licence must be obtained with specified conditions.

VIII. STANDARD TESTS FOR NON-FLAMING CINEMATOGRAPH FILMS.

The British Fire Prevention Committee has observed the efforts made to treat Celluloid cinematograph films in such a manner that they may become less inflammable than in the ordinary way and also similar efforts which have been made to discover substitutes for Celluloid cinematograph films.

It considers such efforts should meet with official encouragement by the lessening of restrictions imposed upon the use of Celluloid films where suitably treated Celluloid films or efficient Celluloid substitutes are used.

The Cinematograph Act applies where inflammable films are used, but it gives no definition of the word "inflammable." This is not satisfactory, as safety films of the highest quality might be termed inflammable in the dictionary sense of this term.

The Committee suggests the introduction of the term "non-flaming," as used by the technical professions for some time to indicate the slow ignition and slow rate of burning.

It is not suggested that the Cinematograph Act be amended so as to exclude its application where efficient "non-flaming" films are employed, as the establishments coming under it at present—and frequently holding audiences of over 1,000—require regulation whether the film used be inflammable or "non-flaming."

But additional regulations (a) setting up a standard requirement for a film that may be described as "non-flaming" and (b) defining certain easements for buildings (more particularly those only holding small audiences) where "non-flaming" films are solely used should be framed. This would lead to a rapid diminution of the use of, storage and renting of highly inflammable Celluloid films.

As previously stated, buildings where "non-flaming" films only are stored, manipulated or rented, should not be brought under these regulations.

A standard requirement for "non-flaming" films should be provided and for this purpose the standard tests used at the testing station are considered as efficient, and certificates are granted to special makes of films complying with the standard for not longer than one year, i.e. that the certificates are renewable annually at one month's notice, or they may be annulled if upon retest two out of three specified series of standard tests be found to show the material in use to be below standard.

The Committee's present series of standard tests is annexed.

CINEMATOGRAPH FILM TESTS.

STANDARD TEST FOR "NON-FLAMING" FILMS.

Cinematograph films can only obtain classification as "*Non-flaming*" if they fulfil the conditions of the four following *Standard Tests*:

TEST No. 1.

A. Three samples, each 1 yard in length, to be cut off from one piece of the film to be tested, shall each be suspended from a wire by a pin or other metal fastening.

B. The test shall be made in a well-ventilated room of a temperature between 60° F. and 75° F. free from draught, the film not being nearer to any wall or similar surface than 3 feet.

C. The lighted end of a taper $\frac{1}{8}$ inch diameter, not more than 12 inches or less than 6 inches long, shall be held steadily at the bottom edge of the lengths of film for 15 seconds.

D. If not more than 20 per cent of the length actually under test has been burned within 15 seconds from the withdrawing of the lighted taper, when taken on the average of the 3 samples, the film shall be considered as passing Test No. 1.

TEST No. 2.

A. Three samples, each 9 inches in length, to be cut off from one piece of the film to be tested shall be placed in the " gate " of the Cinematograph machine or projector from which both the automatic cutout or shutter and Maltese cross have been previously removed. The gate to be only pushed to and *not* latched.

B. The light from the electric arc in the machine to be of a current of 100 amperes.

C. The movement of the machine is to be stopped for 5 minutes after the arc has been alight for at least 10 minutes.

D. If only that part of the film exposed to the rays of the light in the machine through the opening in the " gate " be destroyed at the end of 5 minutes—or only the photographic emulsion melted—taken on the average of the three samples, the film shall be considered as passing Test No. 2.

TEST No. 3.

A. A loosely rolled length of the film to be tested, the quantity to weigh one pound, and the diameter to be not more than 6 inches, to be fastened to a wire with a metal weight of 2 lbs. attached.

B. The film to be ignited by a lighted taper similar to that employed in Test No. 1 by holding the taper steadily against the bottom edge of the roll for 15 seconds, and at the expiration of 10 seconds from the withdrawing of the lighted taper the film is to be plunged into a pail containing 2 gallons of cold water.

C. If the flames are extinguished in 5 seconds from the time of the immersion of the film in the pail of water, and the burning does not continue in any form under the water, and the film cannot be relighted by the steady application of a similar lighted taper held against the bottom edge of the roll for 30 seconds, the film shall be considered as passing Test No. 3.

TEST No. 4.

A. The gelatine emulsion to be first cleaned from the length of film to be tested by means of a cloth and hot water, after which the film is to be carefully dried by a cloth, then three samples, each 1 inch square, to be cut off from the cleaned piece of the film, and further, each to be cut up into 64 equal pieces with scissors. Each set of these 64 pieces to be placed in loosely corked glass test tubes, 6 inches long, $\frac{1}{2}$ inch inside diameter, which are to be suspended in a gas-heated oil bath so that bottoms of the test tubes are not less than $\frac{1}{2}$ inch nor more than $\frac{3}{4}$ inch from the bottom of the oil bath.

B. The oil bath to be of enamelled iron, 8 inches by 6 inches by 5 inches deep, and to contain 1 quart of linseed oil, the oil to be kept constantly stirred by means of a mechanical stirrer or glass rod. A

thermometer to be also suspended in the oil bath so that the end of the bulb is on a level with the bottom of the tubes.

C. The initial temperature to be 212° F. and the gas so regulated that the temperature of the bath rises 10° F. per minute, and this rise in temperature to be continued until the film "fumes off."

D. If the film does not fume off at 500° F., when taken on the average of the samples in the three tubes, the film shall be considered as passing Test No. 4.

An extract from the Committee's Red Book No. 176 (*see* Appendix I) gives the summary of tests recently made on a cinematograph film of a Celluloid substitute known as "Cellit" which was submitted for testing with a view to its being classified by the Committee as "Non-flaming." The tests were of a comparative character, ordinary Celluloid film being tested at the same time. This Celluloid substitute has been classified as "Non-Flaming" and holds the certificate accordingly.

In open air.

Under water.

FIGS. A AND B. A CELLULOID FILM BURNING IN OPEN AIR AND UNDER WATER.

FIG. C. A CELLULOID FILM BURNING IN OPEN AIR.
(*Showing fierceness of flame.*)

FIG. D. A CELLULOID FILM BURNING IN METAL BOX AND BURSTING IT OPEN.

ILLUSTRATIONS FROM RED BOOK NO. 170 OF THE BRITISH FIRE PREVENTION COMMITTEE.

opp. p. 31

APPENDIX I.

Extract from Report No. 176 giving the Summary of Results of certain comparative tests with a non-flaming Celluloid substitute "Cellit" and ordinary Celluloid when used in cinematograph films:—

SUMMARY OF THE TESTS.

The following is a summary of the results of the tests ordered by the Committee:

"CELLIT" FILMS.

The tests demonstrated:—

That a cinematograph film made of "Cellit" is practically a non-inflammable film and may be described as "non-flaming";

That, even if the conditions are such that a loose roll of "Cellit" film should become ignited the film either burns with difficulty or it can easily be put out;

That "Cellit" films may be present in large quantities in a building without materially increasing the fire risk;

That practically little or no objectionable smoke was produced when "Cellit" films were burnt.

CELLULOID FILMS.

The tests demonstrated:—

That an ordinary Celluloid film is extremely inflammable and burns with great rapidity and fierceness;

That a loose roll of Celluloid film when ignited is most difficult to extinguish with water or sand;

That Celluloid films present in a building add most seriously to the fire risk;

That Celluloid films when burning produce a pungent smell and dense suffocating smoke.

The following table summarizes the results of each of the tests:

SUMMARY TABLE OF RESULTS OF TESTS.

(*Average* of results only given.)

TESTS (including Retests & Repeats.) No.	CELLULOID FILMS.	"CELLIT" FILMS.
1	Nitro-cellulose (about 1 gram.) ignited at once, and all consumed.	Acetyl-cellulose (about 1 gram.) ignited with difficulty; 7-24ths of quantity consumed in 57½ sec.
2	Five pieces about 1 yard (*approx. 1m.*) long flared up at once, all being consumed in 6¾ sec.	Six pieces about 1 yard (*approx. 1m.*) long ignited with difficulty. In 3 cases an average of 14⅓ in. (*0·3640m.*) was left when the flame went out in 47⅔ sec. (average).

TESTS (including Retests & Repeats.) No.	CELLULOID FILMS.	"CELLIT" FILMS.
		In 2 cases the taper was raised as the film burnt, until all was consumed in $53\frac{1}{2}$ sec. (average). In 1 instance the match was raised till the film was all consumed.
3	Pieces of film ignited in $5\frac{2}{3}$ sec., and all consumed in $8\frac{1}{4}$ sec.	Pieces not consumed in $41\frac{2}{3}$ sec. In 1 test 2 pieces were singed.
4	Film could be joined with same solution as "Cellit" film.	Film could be joined with same solution as Celluloid film.
5	Emulsion on film started melting in $7\frac{3}{5}$ sec.; the film burst into flame in $15\frac{2}{5}$ sec., all being consumed in $18\frac{1}{3}$ sec.	Emulsion on film started melting in $4\frac{6}{7}$ sec.; in 14 sec. was all melted; film not burnt.
6	Flame extinguished in 7 sec., film all charred.	Film would not ignite.
7	Flame not extinguished till film all charred.	Flame extinguished as soon as benzene consumed; film only charred on edge.
8	Fuse did not carry light inside box. Lid taken off, film ignited; lid replaced, gases generated burst open box, film all charred.	Fuse did not carry light inside box. Test not further proceeded with.
9	(*a*) Ignited film put into water and flame extinguished. (*b*) Ignited film burnt 10 sec. put into water, and yet continued burning till all charred through in 27 sec.	Film could not be ignited.
10	Two buckets of sand would not stop combustion.	Test not attempted.
11	Film fired at $367\frac{2}{3}$°F. (*186° C.*)	Film melted at 518°F. (*270° C.*)

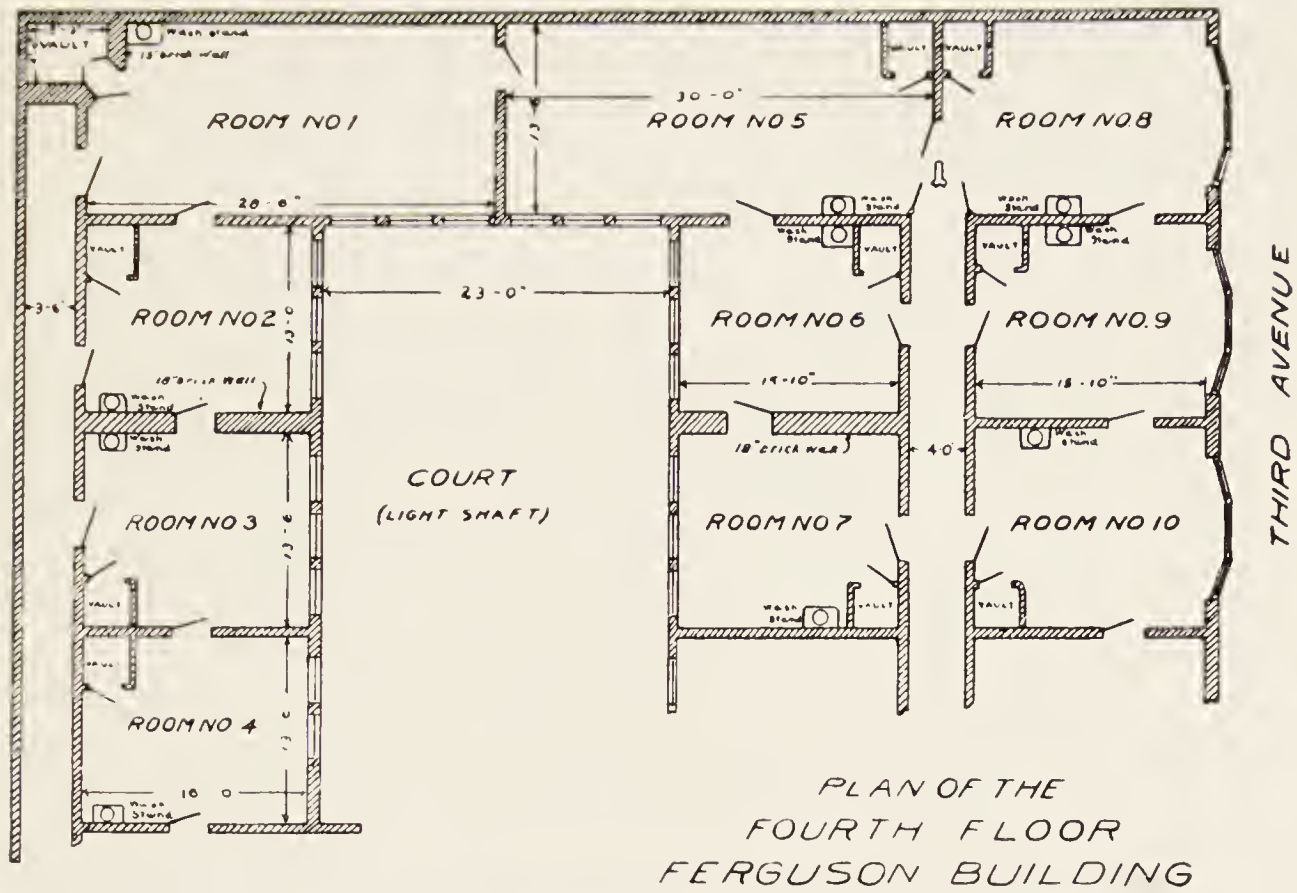
APPENDIX II

Précis of Special Report by The United States Geological Survey, by Clarence Hall and Walter O. Snelling, on the results of experiments undertaken to determine the decomposition products of photographic films, the temperature at which decomposition is brought about and the consequent storage hazard, with special reference to the explosion-fire in the premises of the Columbia Film Co., Ferguson Building, 317/323 Third Avenue, Pittsburg, on September 27, 1909, at 11 a.m.

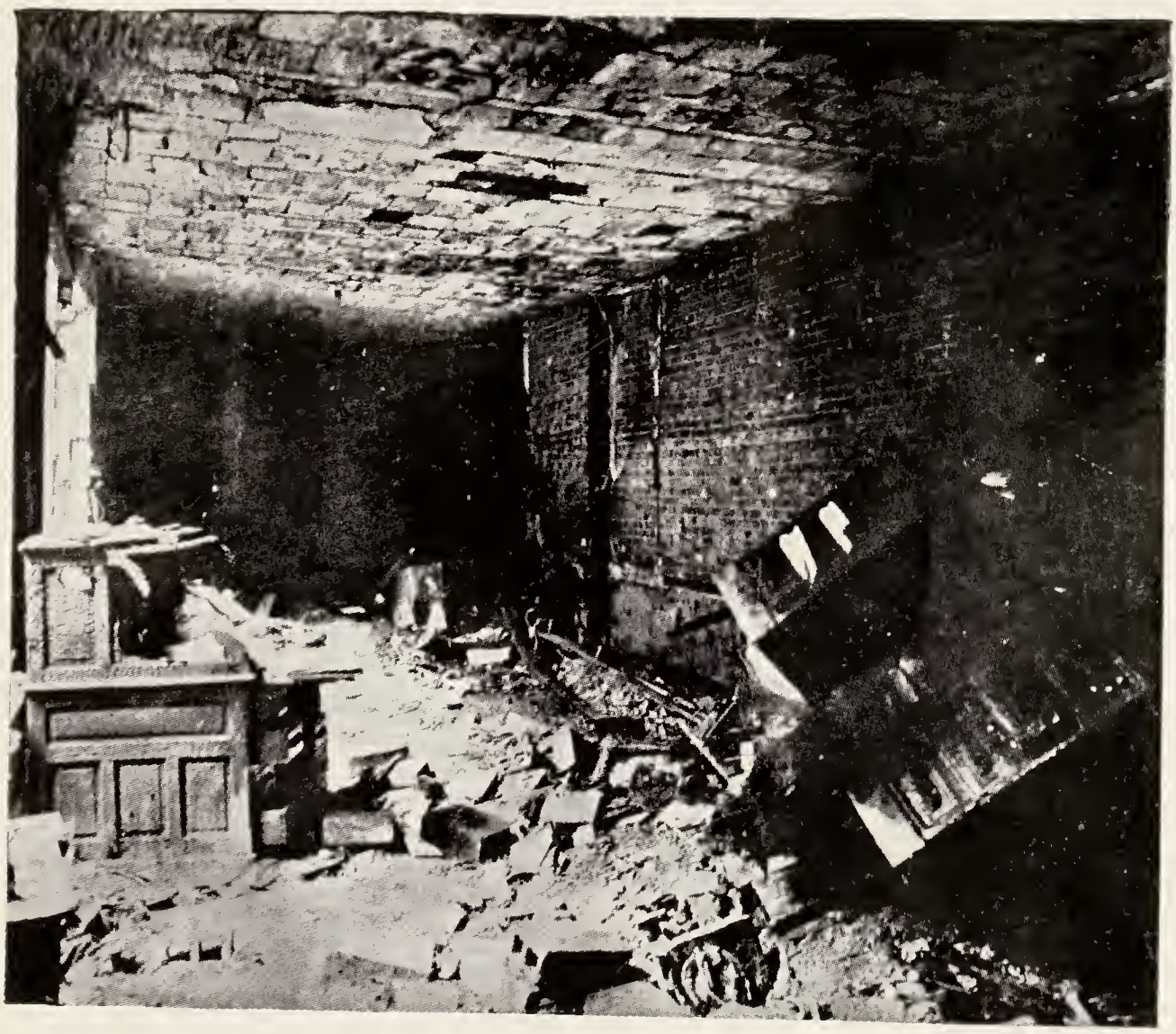
Building. Well constructed seven story office building in business district of Pittsburg.

Firm. Rented cinematograph films to cinematograph shows—generally spoken of in England as film renters. They occupied part of fourth floor.

Cause. An employé went into a vault to get certain reels of film, taking with him an extension electric light. In some manner this



PLAN OF THE
FOURTH FLOOR
FERGUSON BUILDING
SHOWING LOCATION OF VAULT.



FERGUSON BUILDING, PITTSBURG, U.S.A.; ROOM NO. 1.

p. 33.

Room 3. *Room 2.* *Room 1.*

FERGUSON BUILDING, PITTSBURG, U.S.A.; ROOMS NOS. 3, 2 AND 1. *p. 34.*

light set fire to a reel of film. Estimated 185 reels in vault at time. Man seized it and threw it into room, closing vault door.

Room. Used for repairing and examining films, consequently other films here soon ignited from the burning one. Whilst employés escaping a hissing sound was heard, followed by an explosion. On investigation afterwards vault door found shut. Vault approximately 4 ft. by 5 ft. 3 in. by 10 ft. 6 in. Interior showed signs of great heat. Film upon reels had undergone decomposition, leaving only carbonaceous skeleton.

Condition of the room and also adjacent rooms is best explained by the hypothesis of an explosion of gas in this room.

The aforementioned hissing sound might have been produced if gases under high pressure were escaping from vault, and the burning films in the rooms would ignite these.

No evidence that natural gas or gas of any kind present in room immediately before explosion.

Experiments. (1) Cinematograph film, when ignited *with* free access of air, burns vigorously with a brightly luminous flame, and the gases produced are almost wholly carbon dioxide, nitrogen and water vapour, none of these forming explosive mixtures with air.

(2) Film under ordinary atmospheric pressure ignited *without* access of air decomposed and gas mixtures produced, consist essentially of nitrogen dioxide (N_2O_2), carbon monoxide and nitrogen. These gases were found to be inflammable, but as N_2O_2 readily took up oxygen upon gas being mixed with air, difficult to produce explosive mixture.

(3) Gases produced by decomposition of film in a closed space as represented by vault formed, when mixed with proper quantities of air, violent explosive mixtures.

The flameless decomposition brought about in a vessel from which the air had been evacuated gave results as shown in analysis A, and the analysis of decomposition products formed by the decomposition of pyroxylin, when retained in a strong vessel, is represented by analysis B.

	A per cent.	B per cent.
Water soluble	3·7	0·7
Nitrogen dioxide	28·5	—
Carbon dioxide	7·3	7·7
Carbon monoxide	28·3	41·2
Hydro carbons	0·7	3·1
Nitrogen	31·5	26·3
Oxygen	—	2·1
Hydrogen	—	18·9

Experiments indicated that when mixed with air in all proportions from one volume of air with one volume of gas to five volumes of air with one volume of gas, explosions could be produced with "B" mixtures.

(4) Heat tests gave the average of four tests each that the film would decompose as follows:—

150° C. in 4 min. 6 sec.
155° C. in 2 min. 25 sec.
160° C. in 1 min. 43 sec.

Quantity of film. From experiments proved, volume of gas that could be produced from 185 reels (815 pounds) is amply able to explain production of violent explosive mixtures present in the different rooms.

Conclusions. An incandescent electric light globe can ignite film with which it is in contact in a very short time.

APPENDIX III.

FACTORY AND WORKSHOP ACT 1901.

MEMORANDUM.

XYLONITE AND CELLULOID.

The attention of the Factory Department has been directed to alleged injury to health and risks from fire in the manufacture of xylonite and celluloid, and in the use of those materials for manufacturing purposes. It would appear that by the general observance of recognized measures of precaution, already adopted in certain works, further security may be obtained. The following observations are offered after an exhaustive inquiry by Commander Hamilton Smith, one of H.M. Superintending Inspectors of Factories, who has conferred with experts in the matter.

In the manufacture of the raw material, and in its subsequent manipulation, it does not appear that there is any exceptional risk so far as the health of the workers is concerned, excepting in rooms where nitric and sulphuric acids are used, and necessarily give off fumes. These should be drawn away mechanically, at or as near as possible to the point of generation, by suitable exhaust ventilation pipes.

The risk of fire is obvious, having regard to the highly inflammable nature of the substance used. Probably only a proportion of the more serious fires, leading to casualties and loss of property, are brought to the knowledge of the Department, but these have caused many fatalities. Between 1894 and 1904 the records for England alone show 59 fires connected with xylonite or celluloid—50 in the manufacture of those materials (46 in cutlery works in Sheffield), and 9 in places in which it was stored or used.

The following precautions are recommended:

(1) Where large quantities of xylonite or celluloid are stored, fireproof rooms should be provided.

(2) Where xylonite or celluloid is used, or temporarily stored, the material not in actual use should be kept in metal or other fireproof receptacles.

(3) Xylonite or celluloid shavings or dust should not be allowed to accumulate on the floors, but should be swept up daily and placed in receptacles of non-inflammable material, not in the sacks or wooden boxes now commonly employed for the purpose.

(4) The use of naked lights should be avoided as far as possible; if used at all they should be at least three feet from any boring or glazing machine.

(5) Where cutting or sawing of xylonite is done, the saw or other cutting instrument should be run in water, or by other means be kept thoroughly cool.

(6) The shanks of tools used for boring the scales for table knives and forks should be of such form as to avoid friction caused by contact with the material bored.

(7) In addition to a supply of water, buckets filled with damp sand should be kept at hand in constant readiness in every shop in which xylonite or celluloid is being worked, in order that any accidental fire may be immediately smothered before it attains serious proportions.

ARTHUR WHITELEGGE,
Chief Inspector of Factories.

Home Office,
February, 1905.